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COLUMBIA-NORTH PACIFIC REGION COMPREHENSIVE FRAMEWORK STUDY OF --ETC(U)
JUN 70 C C BOWLSBY, R J COFFMAN, C R HUBBARD

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Columbia-North Pacific Region

Comprehensive Framework Study
of Water and Related Lands

APPENDIX IV
VOLUME 2

LAND & MINERAL RESOURCES

SUBMITTED BY

PACIFIC NORTHWEST RIVER BASINS COMMISSION
1 COLUMBIA RIVER, VANCOUVER, WASHINGTON

JUNE 1970

This appendix is one of a series making up the complete Columbia-North Pacific Region Framework Study on water and related lands. The results of the study are contained in the several documents as shown below:

Main Report

Summary Report

Appendices

I. History of Study

II. The Region

III. Legal & Administrative Background

IV. Land & Mineral Resources

V. Water Resources

VI. Economic Base & Projections

VII. Flood Control

VIII. Land Measures & Watershed Protection

IX. Irrigation

X. Navigation

XI. Municipal & Industrial Water Supply

XII. Water Quality & Pollution Control

XIII. Recreation

XIV. Fish & Wildlife

XV. Electric Power

XVI. Comprehensive Framework Plans

Pacific Northwest River Basins Commission
1 Columbia River
Vancouver, Washington

1

Land and Mineral Resources

6

APPENDIX IV

Columbia-North Pacific Region
Comprehensive Framework Study

Volume 2
[Subregions 6-12]

of Water and Related Lands. Appendix IV.
Land and Mineral Resources. Volume 2.
Subregions 6-12,

10

Clyde C./Bowlsby, R. J./Coffman,
C. R./Hubbard, W. A./Post Jack L./Wood

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Submitted by
Pacific Northwest River Basins Commission
Vancouver, Washington

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APPENDIX IV
Land & Mineral Resources

Prepared under the direction of the
Columbia-North Pacific Technical Staff
by the
Land & Minerals Work Group

Clyde C. Bowlsby, Chairman

Department of Agriculture
- C. C. Bowlsby, SCS
- W. A. Post, FS

Department of the Interior
- R. J. Coffman, BLM
- C. R. Hubbard, BM
- A. D. Nelson, BR
- A. E. Weissenborn, GS

Idaho
- J. D. McAndrew
- R. R. Reid

Montana
- R. L. Brown, Jr.

Oregon
- R. S. Mason
- G. H. Simonson
- W. D. Wilkinson

Washington
- M. T. Huntting

Wyoming
- R. J. Tangeman

Principal Authors' Contribution

Clyde C. Bowlsby Soil Conservation Service	Land and Soils
R. J. Coffman Bureau of Land Management	Rangeland
C. R. Hubbard Bureau of Mines	Minerals
W. A. Post Forest Service	Land Ownership, Forest Land
Jack L. Wood Soil Conservation Service	Soils

This appendix to the Columbia-North Pacific Region Framework Report was prepared at field level under the auspices of the Pacific Northwest River Basins Commission. It is subject to review by the interested Federal agencies at the departmental level, by the Governors of the affected States, and by the Water Resources Council prior to its transmittal to the President of the United States for his review and ultimate transmittal to the Congress for its consideration.

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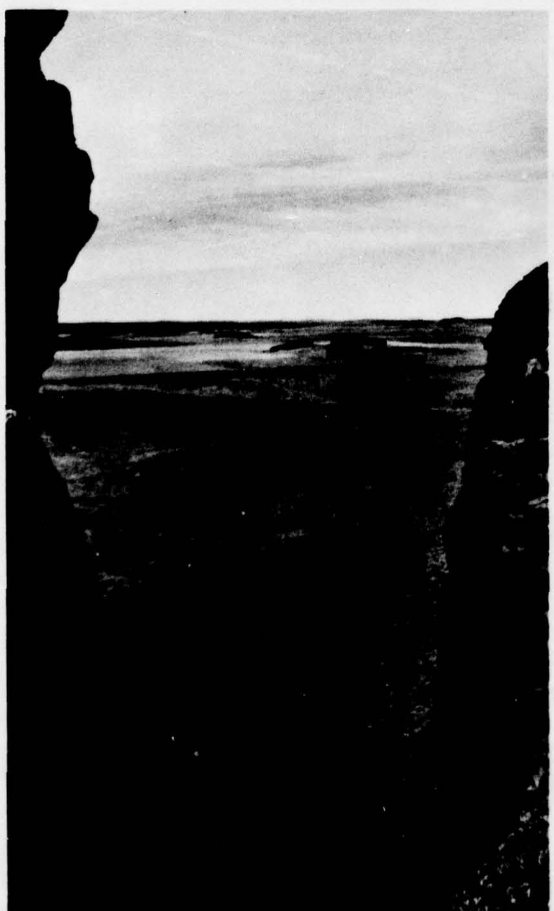
Mountain Scene - Idaho Department of Commerce & Development



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LAND & MINERAL RESOURCES

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SUBREGION 6
LOWER SNAKE

ABSTRACT

The Lower Snake Subregion includes the southeast corner of Washington State, the northeast corner of Oregon, and all of central Idaho within the Clearwater and Salmon River drainage areas. It is bounded on the east partly by the Continental Divide between the Missouri and Columbia drainage basins. The crest of the Bitterroot Mountains separates it from the Clark Fork and the Clearwater drainage basins.

The mountainous eastern part of the subregion includes the generally forested upper reaches of the Snake River drainage and consists mainly of acidic bedrock of the Idaho batholith. The part west of the Seven Devils is principally a cropland-rangeland area with deeply entrenched canyons dissecting a broad westward sloping plateau consisting mostly of basic bedrock of the Columbia River basalt flow.

The land resource includes: (1) The highly productive hilly, wind deposited soil area of Washington and Idaho where a large part of the Nation's soft winter wheat is grown, which is an area with a severe soil erosion and sedimentation problem. (2) The dominantly stony shallow soils area of the basalt plateaus is mainly suited to rangeland use with intermittent cropland areas on moderately deep soils. (3) The steep canyon areas of the Snake and its tributaries are mainly suited to rangeland use, but have isolated small bottom-land and alluvial terrace areas devoted to rather intensive cropland use under irrigation. (4) The area of granitic soils in the Clearwater, Lochsa, and part of the Salmon River Drainage Basin. This area is mostly forested with grass cover at elevations below 3,500 feet. Timber production and grazing are major land uses in this area. Due to the severe erosion potential and because of Federal ownership, this general use probably will not change. A major value of this area is for recreation, wildlife, watershed, and aesthetics. (5) The high, dry area of the Pahsimeroi and Lemhi Drainage basins have soils formed in alluvial material and in mixed material related to underlying sedimentary and basic and acid igneous bedrock. Most of this area is Federally owned and devoted to forest land and rangeland uses; however, some of the alluvial terraces adjacent to drainage ways are privately owned, irrigated and used for hay, grain, and potato production.

Table 133 - Areas by State and County, Subregion 6, 1967

State and County	Water Area Sq. Mi.	Water Area Acres	Land Area 1/ Sq. Mi.	Land Area 1/ Acres	Total Area Sq. Mi.	Total Area Acres
Idaho						
Adams	01.8	1,100	421.5	269,800	423.3	270,900
Benewah	.0	0	23.3	14,900	23.3	14,900
Blaine	06.0	3,900	127.4	81,500	133.4	85,400
Boise	.0	0	01.9	1,200	01.9	1,200
Clearwater	00.8	500	2,510.4	1,606,600	2,511.2	1,607,100
Custer	06.4	4,100	3,570.0	2,284,800	3,576.4	2,288,900
Idaho	05.9	3,800	8,516.1	5,450,300	8,522.0	5,454,100
Latah	.0	0	1,061.6	679,400	1,061.6	679,400
Lemhi	00.6	400	4,193.0	2,683,500	4,193.6	2,683,900
Lewis	02.4	1,500	475.6	304,400	478.0	305,900
Nez Perce	10.3	6,600	843.7	540,000	854.0	546,600
Shoshone	.0	0	381.3	244,100	381.3	244,100
Valley	06.0	3,800	2,396.5	1,533,800	2,402.5	1,537,600
Total Idaho	40.2	25,700	24,522.3	15,694,300	24,562.5	15,720,000
Oregon						
Baker	00.4	300	08.0	5,100	08.4	5,400
Umatilla	00.4	300	50.0	32,000	50.4	32,300
Union	01.6	1,000	1,745.0	1,116,800	1,746.6	1,117,800
Wallowa	02.9	1,800	3,147.3	2,014,300	3,150.2	2,016,100
Total Oregon	05.3	3,400	4,950.3	3,168,200	4,955.6	3,171,600
Washington						
Adams	05.8	3,700	501.5	321,000	507.3	324,700
Asotin	03.6	2,300	633.4	405,400	637.0	407,700
Columbia	03.4	2,200	459.6	294,100	463.0	296,300
Franklin	11.4	7,300	310.0	198,400	321.4	205,700
Garfield	04.2	2,700	712.8	456,200	717.0	458,900
Lincoln	00.5	300	108.1	69,200	108.6	69,500
Spokane	04.7	3,000	365.8	234,100	370.5	237,100
Walla Walla	32.3	20,700	249.1	159,400	281.4	180,100
Whitman	14.3	9,200	2,142.1	1,370,900	2,156.4	1,380,100
Total Washington	80.2	51,400	5,482.4	3,508,700	5,562.6	3,560,100
Total Subregion	125.7	80,500	34,955.0	22,371,200	35,080.7	22,451,700

1/ The term "land" is defined to include all water bodies under 40 acres and streams under one-eighth mile in width.
Source: U.S.D.A. Conservation Needs Inventory adjusted to the U.S. Census.

The principal metals found in Subregion 6 are gold, silver, copper, lead, zinc, cobalt, antimony, tungsten, mercury, thorium, rare earths, columbium, and tantalum; nonmetals of importance are sand and gravel, stone, clay, mica, kyanite, fluorspar, and garnet. No significant deposits of mineral fuels exist.

The Idaho batholith and marginal zones in Clearwater, Idaho, and Valley counties, and the adjoining area of Challis volcanics in Lemhi and Custer counties, Idaho, together with the small granitic area south of Enterprise in Wallowa County, Oregon, contain most of the metalliferous deposits. Gold is the most widespread metal occurring both as placer and lode deposits; placer gold accounted for most of the early mineral production.

Substantial production of gold, silver, copper, lead, and zinc has come from the subregion; and, in addition, for several years it accounted for almost the entire domestic production of antimony, cobalt, columbium, and tantalum. In critical periods of short supply during World War II years, it produced nearly 40 percent of the domestic production of tungsten and an important part of the total mercury produced. The subregion contains the largest known domestic resources of thorium and rare earths--minerals of great importance in the coming nuclear age.

Mining is currently at a much reduced scale, but has a high potential for future mineral production.

The total area of Subregion 6 consists of over 99 percent land and less than 1 percent water. Table 133 shows the land, water, and total acreages by states and counties. Except for table 133, the areas of land only will be recorded in acreages throughout the following discussion.

LAND

Factors of major importance to the land resource are: the ownership status, the soils, and the present use. The combination of these factors greatly influences the present and future utilization of the land resource.

Land Ownership

The Lower Snake Subregion contains almost 22.4 million acres. The largest landowner is the Federal Government with 13.8 million acres or 62 percent of the total land area. Mixed private ownerships amount to over 7.8 million acres or 35 percent of the land area. State, county, and municipal ownerships make up the balance.

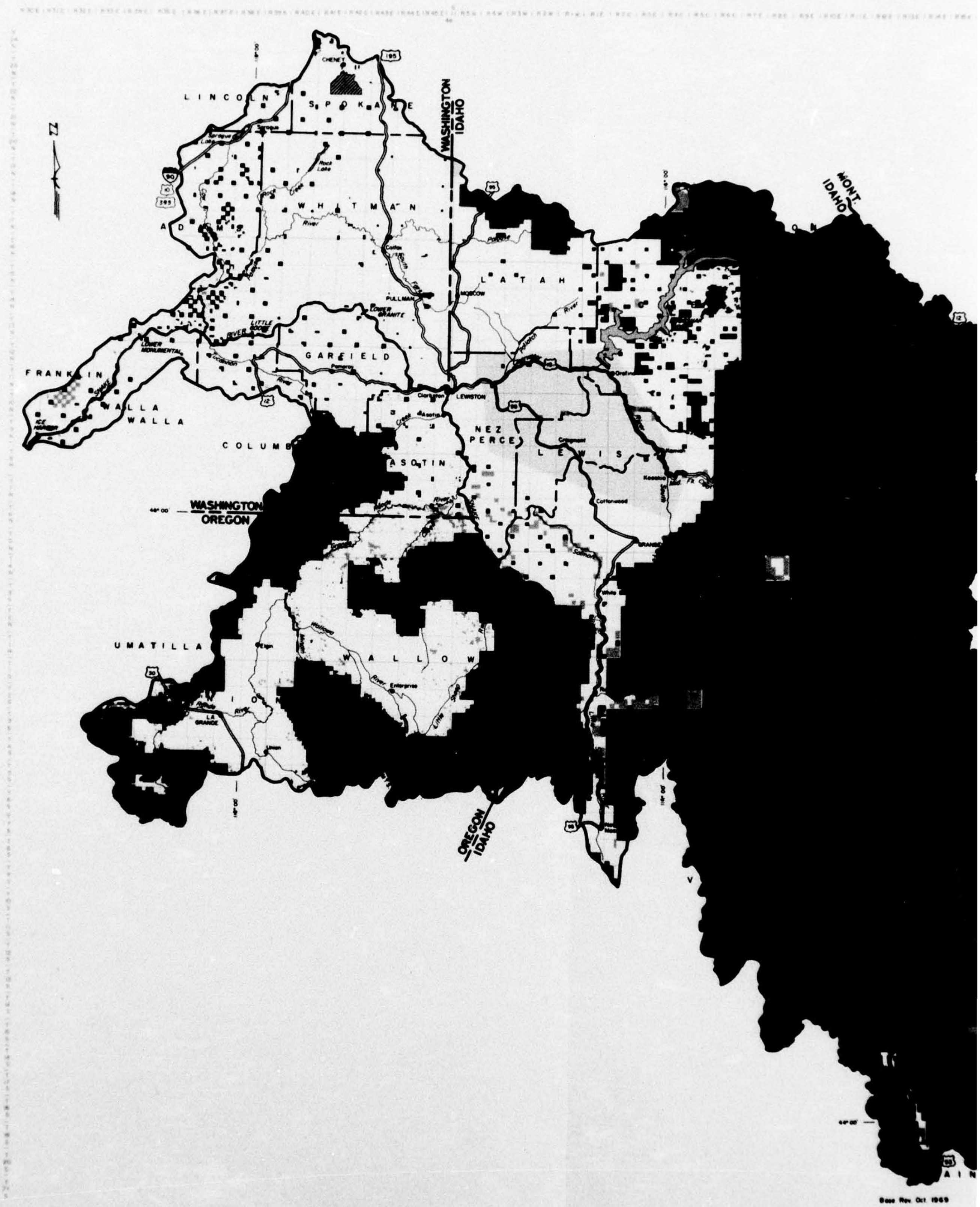
Over 12.3 million acres of the public lands are in the national forests, with another 1.3 million acres of Public Domain. Almost 100,000 acres are other Federal holdings including wildlife refuges, defense installations, and reclamation projects. State, county, and municipal governments hold 740,000 acres. Nearly 90,000 acres are Indian Reservations.

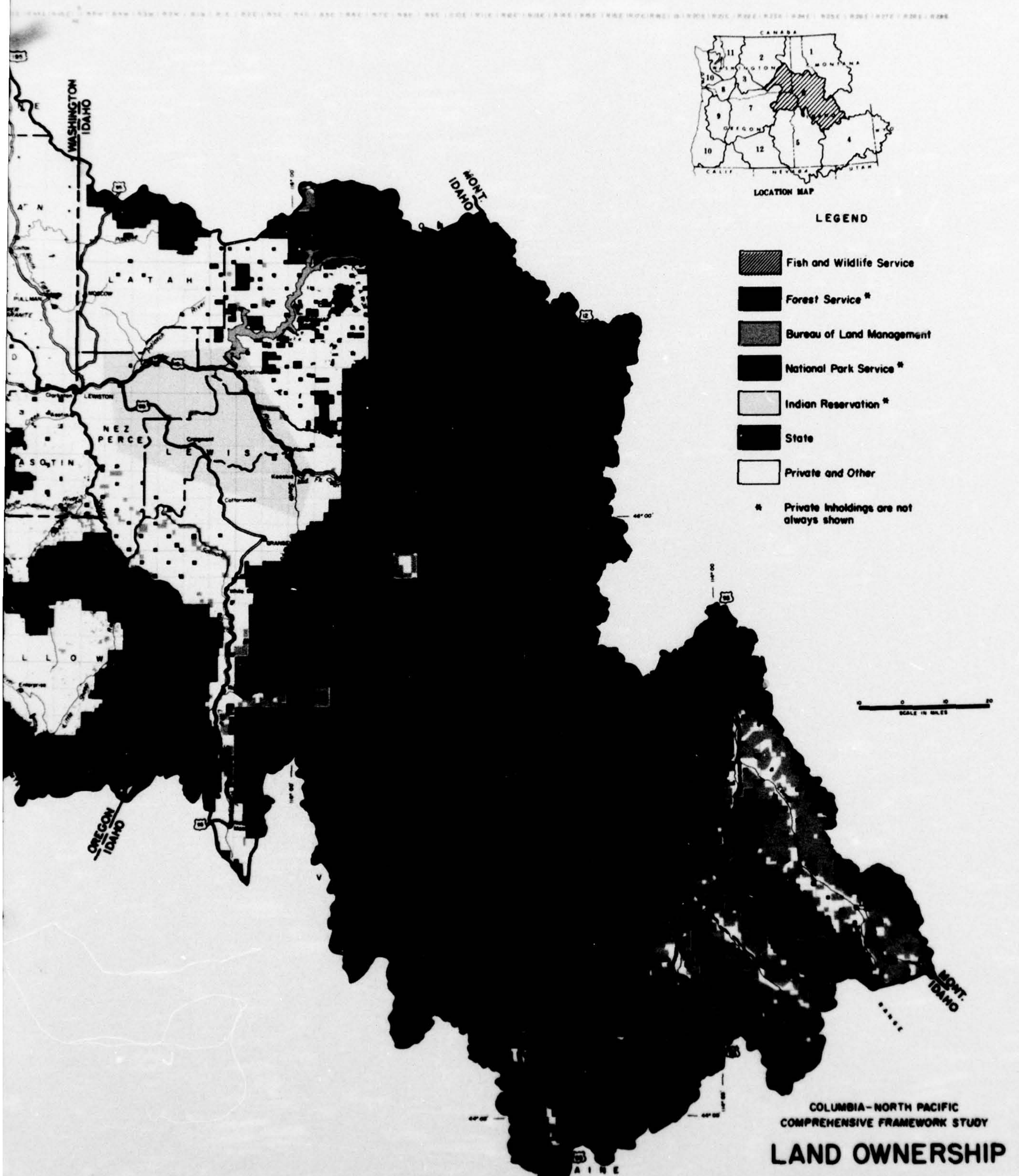
Table 134, Land Ownership, and figure 26, Land Ownership Map, show this information in more detail.

Table 134 - Land Ownership Acreage, Subregion 6, 1965

Administering Agencies	Idaho	Washington	Oregon	Total Subregion 6
		(1,000 acres)		
Department of Agriculture				
Forest Service	10,391.0	269.9	1,678.1	12,339.0
Other Agriculture	-	.2	-	.2
Subtotal	10,391.0	270.1	1,678.1	12,339.2
Department of the Interior				
Bureau of Land Management	1,238.2	15.3	22.0	1,275.5
Bureau of Indian Affairs 1/	89.6	-	-	89.6
National Park Service 2/	1.5	-	-	1.5
Fish & Wildlife Service	-	14.5	-	14.5
Bureau of Reclamation	2.6	-	-	2.6
Other Interior	-	-	-	-
Subtotal	1,331.9	29.8	22.0	1,382.2
Department of Defense	39.8	41.3	-	81.1
Other Federal	-	-	-	-
Federal Subtotal	11,762.7	341.2	1,700.1	13,803.7
State	495.6	183.9	26.4	705.9
County	21.2	2.2	2.8	26.2
Municipal	3.8	2.1	2.9	8.8
Public Non-Federal Subtotal	520.6	188.2	32.1	740.9
Total Public	12,283.3	529.4	1,732.2	14,544.9
Total Private	3,411.0	2,979.3	1,436.0	7,826.3
Grand Total	15,694.3	3,508.7	3,168.2	22,371.2

1/ Private lands held in trust by the Federal Government.
2/ Data updated to 1969.
Source: General Services Administration Real Property Owned by the United States as of June 30, 1965, adjusted by the Land and Minerals Work Group.


LINCOLN
SPOKANE
CHENEY
WASHINGTON
IDAHO
WHITMAN
ADAMS
LATAH
PULLMAN
MOSCOW
LOWER GRANITE
LITTLE GOOSE
LOWER MONUMENTAL
GARFIELD
FRANKLIN
WALLA WALLA
ICE HARBOR
COLUMBIA
Clarkston
LEWISTON
ASOTIN
NEZ PERCE
LEWIS
Cottonwood
WASHINGTON
OREGON
UMATILLA
WALLOWA
Enterprise
LA GRANDE
OREGON
IDAHO
MONT.
IDAHO
Base Rev. Oct. 1969



COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

LAND OWNERSHIP

LOWER SNAKE, SUBREGION 6

1968

FIGURE 26

Soils

Figure 27, the Soil Associations Map, shows the location and relative extent of each soil association. These associations are numbered in a general relationship to the position in the landscape. Thus, bottomland and low terraces have the lowest numbers and alpine areas have the highest. The name of each association relates to the soil series representing general kinds of soils that are most extensive in the landscape. Wherever possible, established soil series are used in the name; however, where the soil series do not have classification status, the soil series name is not recorded. Generally up to 15 percent of any soil association in known areas may consist of inclusions of soils other than those identified. Such inclusions may be similar soils or they may be highly contrasting. However, in many high mountainous areas where detailed knowledge about the area is incomplete, extensive areas are included within delineations and inclusions of other soils may exceed the 15 percent general average.

Table 135 contains information about each soil association shown on figure 27. The symbol listed in the second column on the table is the same symbol shown on the soil association map. The table is organized to show land characteristics and the characteristics, qualities, and some interpretations of soil series representing the dominant and the contrasting kinds of soil in each association. The first six columns show some general land characteristics for each soil association. The next 11 columns show characteristics (permanent soil facts) of individual key soil series that represent dominant and contrasting soils. The following four show qualities inferred from the characteristics of these soils, and the last four show interpretations concerning agricultural use based upon the foregoing soil characteristics and qualities. All of the representative soil series listed have status in classifications. A blank space in the soil series column indicates that the soil series name has no classification status.

The "soil groups" column contains soil associations that have broad similarities in some important characteristics and are frequently integrated into a position on the landscape.

The "percentage of association" column shows the extent of each soil in an association. Differences of the total soil percentage in each association from 100 percent are inclusions of other soils and land types. For example, soil association 3 lists a total of 75 percent. Knowledge of this area is somewhat limited so that 25 percent of its area consists of inclusions of other soils that are not defined.

Terms listed for permeability of water through the subsoil and permeability of substratum are:

Very rapid: Over 10 inches per hour.
Rapid: 5 to 10 inches per hour.
Moderately rapid: 2.50 to 5 inches per hour.
Moderate: 0.8 to 2.5 inches per hour.
Moderately slow: 0.2 to 0.8 inches per hour.
Slow: 0.05 to 0.2 inches per hour.
Very slow: Less than 0.05 inches per hour.

Terms listed for total available water-holding capacity are:

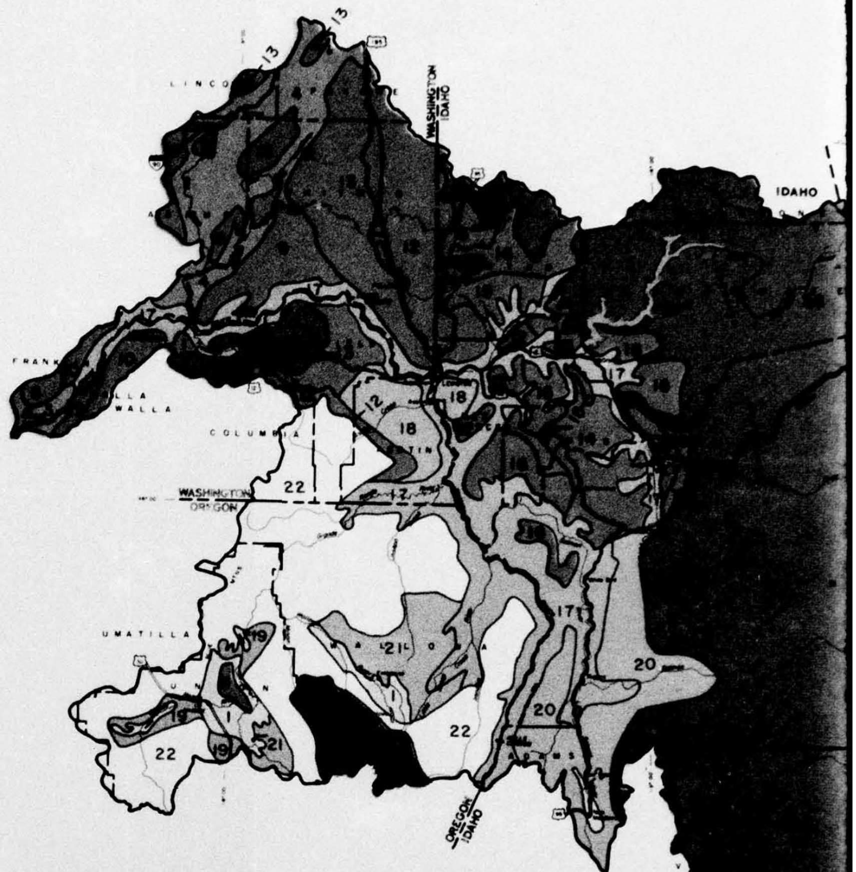
Low: Less than 6 inches in profile.
Medium: 6 to 10 inches.
High: More than 10 inches in profile.

The irrigated capability subclasses are limitations and hazards of using presently irrigated lands.

A dash indicates that a column does not apply or there is not enough information to complete it.

Tables 135 and 136 present data that define environment, characteristics, qualities, acreage, and extent of soil associations They show 10 soil associations, amounting to over 16 percent of the subregion, that dominantly have silty profiles and only minor gravelly areas. This, of course, is the wind deposited wheat producing area of eastern Washington and west-central Idaho. About 33 percent of the subregion occurs in the soil association 26 and relates to the underlying granitic bedrock of the Idaho batholith. Lack of information about the area of this association is reflected in the size of the delineation. Detail of soil occurrences will demand segregation of smaller areas when the landscape is diagnosed in greater detail. However, the general area reflects the potential erosion hazard and high quartz content common to all soils formed in residuum-colluvium from granite. The tables also show over 6 percent of the soil was formed in deep beds of glacial material and contains restrictive amounts of coarse fragments. About 24 percent of the soil areas have restrictive amounts of coarse fragments and are only moderately deep to shallow over bedrock of the Columbia River Basalt flow.

Table 136 shows the estimated acreage and proportionate extent of the soil associations by states.



LEGEND REVISED 1970

LEGEND

Soil Associations Map Symbol *	Name of Association

Generally silty and sandy soils formed in alluvial sediments on bottomlands and low terraces.

1	LaGrande - Veazie
2	Archabal - Blackwell

Generally silty and sandy soils with coarse fragments formed in glacial materials on terraces, plains and mountains.

3	Sagemoor - Hezel
4	Hesseltine - Benge
5	Gini - Ramshorn

Generally silty or sandy soils formed in wind deposited or wind worked sediments on hilly uplands.

6	Quincy
7	Adkins - Burke
8	Bagdad - Anders
9	Walla Walla - Chard
10	Ritzville - Magallon
11	Imbler - Alicel
12	Naff - Palouse
13	Athena - Pataha
14	Nez Perce
15	Larkin - Southwick
16	Santa - Helmer

Generally silty soils formed in materials mixed with rocky residuum-colluvium from basic rock types on plateaus, canyons and mountains.

17	Kuhl - Linville
18	Asotin - Kuhl
19	Rock Creek - Waha
20	Dominantly Argixerolls
21	Hall Ranch - Zumwalt

Generally sandy soils formed in materials mixed with volcanic ash or pumice on terraces, foothills, plateaus and mountains.

22	Dominantly Vitrandepts
23	Frigid Soils

Generally silty soils formed in materials mixed with gravelly residuum-colluvium from sedimentary bedrock on mountains.

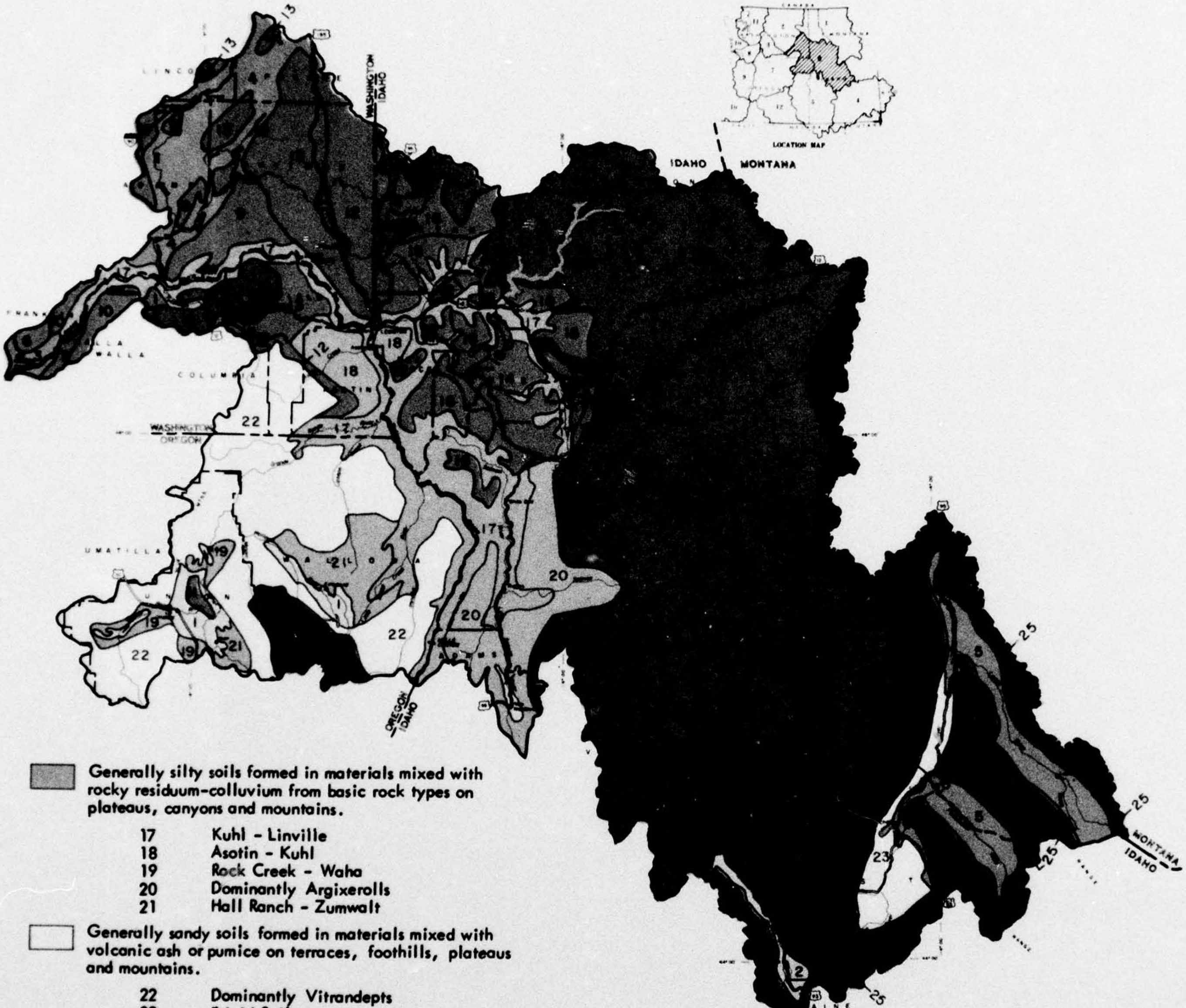
24	Dominantly Argixerolls
25	Rockland

Generally sandy soils formed in materials mixed with rocky residuum-colluvium from acidic rock types on terraces, foothills and mountains.

26	Dominantly Cryandepts

** Symbols are non-conotative and consistent only within each subregion. To compare delineations from one subregion to another refer to the name of the Soil Association.*

NOTE: The Soil Association name may include a series that does not fit the Soil Associations Group description. The Soil Association name is based on dominant series. The dominant of five series may be only 30 percent of the Soil Association. Thus a clayey textured soil series may be included in a group accurately described as generally silty and sandy in texture.



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- Generally silty soils formed in materials mixed with rocky residuum-colluvium from basic rock types on plateaus, canyons and mountains.
  - 17 Kuhl - Linville
  - 18 Asotin - Kuhl
  - 19 Rock Creek - Waha
  - 20 Dominantly Argixerolls
  - 21 Hall Ranch - Zumwalt
- Generally sandy soils formed in materials mixed with volcanic ash or pumice on terraces, foothills, plateaus and mountains.
  - 22 Dominantly Vitrandepts
  - 23 Frigid Soils
- Generally silty soils formed in materials mixed with gravelly residuum-colluvium from sedimentary bedrock on mountains.
  - 24 Dominantly Argixerolls
  - 25 Rockland
- Generally sandy soils formed in materials mixed with rocky residuum-colluvium from acidic rock types on terraces, foothills and mountains.
  - 26 Dominantly Cryandepts

** Symbols are non-conotative and consistent only within each subregion. To compare delineations from one subregion to another refer to the name of the Soil Association.*

NOTE: The Soil Association name may include a series that does not fit the Soil Associations Group description. The Soil Association name is based on dominant series. The dominant of five series may be only 30 percent of the Soil Association. Thus a clayey textured soil series may be included in a group accurately described as generally silty and sandy in texture.

COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

SOIL ASSOCIATIONS

LOWER SNAKE, SUBREGION 6

2

FIGURE 27

Table 135 - Characteristics and Qualities of Representative Soils, Subregion 6[1/]

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth	Permeal Sub
Moderately deep to very deep soils with loamy and clayey subsoils on nearly level slopes.	1	2,600-4,500	11-20	60-135	Cropland (cereals, grass, alfalfa, peas & fruit orchards)-50% irrigated	Aquic Haploxerolls	Fine-silty, mixed, mesic	La Grande	25	Fans and terraces	Alluvium	Silt loam and silty clay loam	Silt loam & silty clay loam	None	--	60"+	Moderat moderat slow
					Rangeland	Cumulic Haploxerolls	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Veazie	20	Flood plains & terraces	Alluvium over outwash	Sandy loam to silt loam	Silt loam & silty clay loam	Gravel	0-20 in profile; 60 below 40"	40" over gravel	Moderat moderat slow
						Aquic Haploxerolls	Coarse-silty, mixed, mesic	Hot Lake	15	Flood plains	Volcanic ash and alluvium	Silt loam and silty clay loam	Silt loam	None	--	60"+	Moderat
						Aeric Xeric Argialbolls	Fine, montmorillonitic, mesic	Conley	10	Swales	Alluvium	Silt loam and silty clay loam	Clay	None	--	10-40" over clay	Very sl
						Aquic Durixerolls	Loamy, mixed, mesic		10	Flood plains	Volcanic ash and alluvium	Silt loam	Silt loam	None	--	10-40" over hardpan	Moderat
						Ultic Haploxerolls	Loamy-skeletal, frigid	Emily	10	Fans	Alluvium over outwash	Silt loam	Clay loam & silty clay loam	Gravel	60 below 40-60"	40-60" over gravel	Moderate slow
Moderately deep to very deep cold soils with loamy subsoils on nearly level slopes.	2	4,800-6,800	18-25	30-75	Cropland (cereals and hay)-80% irrigated	Argic Cryoborolls	Fine-loamy, mixed	Archabal	40	Fans and terraces	Alluvium over outwash	Loam	Loam	Sand and gravel	60-80 below 40-60"	40-60" over sand and gravel	Moderate
					Rangeland Forest land	Typic Cryaquolls	Fine-loamy, mixed, noncalcareous	Blackwell	15	Flood plains	Alluvium over outwash	Clay loam	Sandy clay loam	Sand and gravel	80 below 20-40"	20-40" over sand and gravel	Moderate slow
					Recreation (fishing, camping & hunting)	Cumulic Haplaquolls	Fine-silty, mixed, noncalcareous, mesic	Catherine	15	Flood plains	Alluvium	Silt loam	Silt loam	None	--	60"+	Moderate
						Typic Argixerolls (Udic Argiustolls)	Fine-loamy, mixed, mesic	Mehlhorn	15	Uplands	Loess over basic igneous rock	Loam	Cobbly clay loam	Cobbles	20-35 below 10"	20-40" over bedrock	Moderate slow

Table 135 - Characteristics and Qualities of Representative Soils, Subregion 6[1]

...on	Soil Characteristics						Soil Qualities and Interpretations							
				Coarse Fragments						Total Available Water-holding Capacity	Range of: Major Capability Subclass			
...ape	Parent Material	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class		Dryland	Irrigated[6]	Major Soil Problems	Suitable Land Treatment and Structures
...nd ...es	Alluvium	Silt loam and silty clay loam	Silt loam & silty clay loam	None	--	60"+	Moderate and moderately slow	Moderately slow	Somewhat poor	High	IIw	IIw	High seasonal water table; flooding	Flood protection; cropping sequence
...& ...es	Alluvium over outwash	Sandy loam to silt loam	Silt loam & silty clay loam	Gravel	0-20 in profile; 60 below 40"	40" over gravel	Moderate and moderately slow	Very rapid	Good	Low and medium	IIIs IVs	IIe IIIs IVs	Droughtiness; flooding	Flood protection; cropping sequence
	Volcanic ash and alluvium	Silt loam and silty clay loam	Silt loam	None	--	60"+	Moderate	Moderate	Somewhat poor and poor	High	IIIe	IIIe	Erosion; high seasonal water table; flooding	Flood protection; cropping sequence
	Alluvium	Silt loam and silty clay loam	Clay	None	--	10-40" over clay	Very slow	Very slow	Poor	High	IIIe	IIIe	Erosion; wetness; clay subsoil; restricts water and roots	Subsurface tillage; drainage; cropping sequence
	Volcanic ash and alluvium	Silt loam	Silt loam	None	--	10-40" over hardpan	Moderate	Impervious to hardpan	Somewhat poor	Low and medium	IIIs	IIIs	Strongly cemented hardpan at 10-40" deep; moderately & strongly alkaline	Subsurface tillage; regulate alkalinity; cropping sequence
	Alluvium over outwash	Silt loam	Clay loam & silty clay loam	Gravel	60 below 40-60"	40-60" over gravel	Moderately slow	Very rapid	Good	Medium and high	--	IIIe	Droughtiness; erosion	Cross-slope operations; residue mgmt; irrigation; mgmt; cropping sequence
...and ...ces	Alluvium over outwash	Loam	Loam	Sand and gravel	60-80 below 40-60"	40-60" over sand and gravel	Moderate	Very rapid	Good and moderately good	Medium and high	IVc	IVe	Droughtiness; erosion	Irrigation mgmt; cross-slope operations; residue management
...s	Alluvium over outwash	Clay loam	Sandy clay loam	Sand and gravel	80 below 20-40"	20-40" over sand and gravel	Moderately slow	Very rapid	Poor	Low and medium	IVw	IVw	Wetness	Drainage
...s	Alluvium	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate and moderately slow	Somewhat poor or poor	High	IVw	IVw	Wetness	Drainage
...ds	Loess over basic igneous rock	Loam	Cobbly clay loam	Cobbles	20-35 below 10"	20-40" over bedrock	Moderately slow	Impervious	Good	Low	IVe	IVe	Erosion; cobbly subsoil; moderately deep over bedrock	Cross-slope operations; residue management

Table 135 - Continued

Soil Association						Classification			Percentage 3/ of Assn.	Position on Landscape	Soil Characteristics						
Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series 2/			Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth	Permeabil[ity] Subsoi[l]
Moderately deep to very deep soils with loamy and sandy subsoils on gentle to strong slopes.	3	300-1,500	6-8	160-200	Cropland (cereals, alfalfa, sugar beets, potatoes, vegetables & pasture)-irrigated Rangeland	Xerollic Camborthids	Coarse-silty, mixed, mesic	Sagemoor	25	Terraces	Loess over lacustrine material	Silt loam	Silt loam	None	--	30-40" over stratified sediments	Moderate
						Typic Torriorthents	Coarse-loamy, mixed, nonacid, mesic	Hezel	25	Terraces	Sand over lacustrine material	Loamy fine sand	Loamy fine sand	None	--	30-40" over stratified sediments	Rapid
						Xerollic Camborthids	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Ephrata	10	Terraces	Alluvium over outwash	Sandy loam	Sandy loam	Sand and gravel	80 below 20-40"	20-40" over sand and gravel	Rapid
						Xerollic Camborthids	Coarse-silty, mixed, mesic	Warden	10	Fans	Loess	Silt loam	Silt loam	None	--	60"+	Moderate
						Typic Torripsamments	Mixed, mesic	Quincy	5	Terraces	Sand	Loamy fine sand	Fine sand	None	--	60"+	Very rapi[d]
Shallow and moderately deep soils with cobbly, gravelly loamy subsoils on gentle to moderate slopes.	4	1,500-3,000	12-18	120-160	Rangeland Cropland (cereals, hay and pasture)-dryland Forest land	Typic Argixerolls	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Hesseltine	20	Terraces	Loess over glacial outwash	Silt loam	Silt loam	Cobbles gravel and stones	0-20 in profile; 60 below 20-40" in places	10-40" over gravel or bedrock	Moderate
						Calcic Haploxerolls	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Benge	20	Terraces	Glacial outwash	Gravelly silt loam	Gravelly silt loam	Gravel	20-35 in profile; 60 below 20-40"	20-40" over gravel	Moderate
						Calcic Haploxerolls	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Stratford	20	Uplands (plains)	Loess over basic igneous rock	Silt loam	Silt loam	Cobbles and stones	0-20 in profile in places	20-40" over bedrock	Moderate
						Typic Haploxerolls	Coarse-loamy, mixed, mesic	Bong	5	Terraces	Sandy glacial outwash	Silt loam to sandy loam	Fine to coarse sandy loam	None	--	20-40" over sand	Moderate[ly] rapid to very rap[id]
						Mollic Andaquepts	Ashy, nonacid, mesic	Cocolalla	3	Basins and potholes	Alluvium & volcanic ash	Silty clay loam	Silt loam to clay loam	None	--	40-60" over bedrock	Moderate[ly] moderate[ly] slow
						--	--	Rockland 5/	3	Uplands	Basic igneous rock	--	--	--	--	10-20" over bedrock	--

Table 135 - Continued

Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Range of: Major Capability Subclass: Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
Soil Characteristics						*Soil Qualities and Interpretations*							
Loess over lacustrine material	Silt loam	Silt loam	None	--	30-40" over stratified sediments	Moderate	Very slow	Good	Medium and high	IVe VIe	IIs IIIe IVe	Erosion; strongly alkaline lacustrine material below 30"	Irrigation management; cross-slope operations; residue management; cropping sequence
Sand over lacustrine material	Loamy fine sand	Loamy fine sand	None	--	30-40" over stratified sediments	Rapid	Very slow	Good	Low	VIe	IIIe IVe	Wind & water erosion; alkaline lacustrine material below 30"	Irrigation management; cross-slope operations; residue mgmt; cropping sequence
Alluvium over outwash	Sandy loam	Sandy loam	Sand and gravel	80 below 20-40"	20-40" over sand and gravel	Rapid	Very rapid	Good	Low	IVe, VIe VIIe VIIs	IIIe VIe	Erosion; droughtiness	Irrigation mgmt; cross-slope operations; residue mgmt; cropping sequence
Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IVe VIe VIIe	I, IIe IIIe IVe	Erosion	Irrigation mgmt; cross-slope operations; residue mgmt; cropping sequence
Sand	Loamy fine sand	Fine sand	None	--	60"+	Very rapid	Very rapid	Excessive	Low	VIIe	IVe, VIe VIs	Erosion; droughtiness	Residue mgmt; irrigation mgmt; cropping sequence
Loess over glacial outwash	Silt loam	Silt loam	Cobbles gravel and stones	0-20 in profile; 60 below 20-40" in places	10-40" over gravel or bedrock	Moderate	Very rapid and impervious	Good	Low and medium	IVe VIs VIIs	--	Droughtiness; shallow & moderately deep over gravel or bedrock	Forest land & rangeland mgmt; cross-slope opers; residue mgmt; cropping sequence
Glacial outwash	Gravelly silt loam	Gravelly silt loam	Gravel	20-35 in profile; 60 below 20-40"	20-40" over gravel	Moderate	Very rapid	Good	Low	IIIs IIIe VIIs	--	Droughtiness; gravelly profile	Rangeland management; residue mgmt; irrigation mgmt; cropping sequence
Loess over basic igneous rock	Silt loam	Silt loam	Cobbles and stones	0-20 in profile in places	20-40" over bedrock	Moderate	Impervious	Good	Low and medium	IVe VIIs	--	Erosion; moderately deep over bedrock	Cross-slope operations; residue mgmt; cropping sequence
Sandy glacial outwash	Silt loam to sandy loam	Fine to coarse sandy loam	None	--	20-40" over sand	Moderately rapid to very rapid	Very rapid	Somewhat excessive	Low	IIIe IVe	--	Erosion; droughtiness; sandy profile	Cross-slope operations; residue mgmt; cropping sequence
Alluvium & volcanic ash	Silty clay loam	Silt loam to clay loam	None	--	40-60" over bedrock	Moderate & moderately slow	Impervious	Poor	Medium and high	IVw Vw	--	High seasonal water table	Drainage; cropping sequence
Basic igneous rock	--	--	--	--	10-20" over bedrock	--	Impervious	Good	Low	VIIIs	--	Shallow over bedrock	Cropping sequence

Table 135 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Per
Shallow and moderately deep, frigid soils with gravelly, loamy and clayey subsoils on gentle to moderate slopes.	5	4,000-6,000	6-11	80-120	Rangeland Cropland (cereals, hay and potatoes)-irrigated	Typic Haplargids	Fine-loamy, mixed, frigid	Gini	40	Fans and terraces	Alluvium over outwash	Loam	Gravelly clay loam	Gravel and sand	20-35 below 10"; 80 below 20-40"	20-40" over gravel and sand	Mod slo
						Xeric Torriorthents	Loamy-skeletal, carbonatic, frigid	Ramshorn	20	Fans and terraces	Alluvium over outwash	Loam	Very gravelly loam	Gravel	35-80 below 10"	10-20" over gravel	Mod rap
						Mollic Haplargids	Fine-silty, mixed, frigid		20	Terraces	Alluvium over outwash	Silt loam	Silty clay loam	Gravel	--	40-60" over gravel	Mod slo
						Typic Ustorthents	Fine-montmorillonitic, calcareous, frigid		10	Fans and terraces	Alluvium	Clay	Clay	None	--	60"+	Slo
						Typic Haplaquolls	Fine-loamy, mixed, calcareous, frigid	Tew	5	Flood plains	Alluvium over outwash	Loam	Loam	Sand and gravel	80 below 20-40"	20-40" over sand and gravel	Mod
Very deep soils with sandy profiles on gentle to moderate slopes.	6	300-1,500	6-8	160-200	Rangeland	Typic Torripsamments	Mixed, mesic	Quincy	95	Duned terraces	Sand	Loamy fine sand	Fine sand	None	--	60"+	Very
Very deep to moderately deep soils with silty profiles on gentle to steep slopes.	7	300-1,500	6-8	160-200	Cropland (cereals) dryland Rangeland	Xerollic Camborthids	Coarse-loamy, mixed, mesic	Adkins	60	Uplands	Loess	Fine sandy loam	Fine sandy loam	None	--	60"+	Mode rapi
						Xerollic Durorthids	Coarse-silty, mixed, mesic	Burke	10	Terraces	Loess over basic igneous rock	Silt loam	Silt loam	None	--	20-30" over hardpan	Mode
						Lithic Xerollic Camborthids	Loamy, mixed, mesic	Starbuck	10	Uplands	Loess and basic igneous rock	Stony silt loam	Stony silt loam	Cobbles and stones	20-35 in profile	10-20" over bedrock	Mode

Table 135 - Continued

...ion ...cape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass 6/: Dryland	Range of: Major Capability Subclass 6/: Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
...and ...ces	Alluvium over outwash	Loam	Gravelly clay loam	Gravel and sand	20-35 below 10"; 80 below 20-40"	20-40" over gravel and sand	Moderately slow	Very rapid	Good	Low and medium	IIIc	IIIe	Droughtiness; erosion	Irrigation mgmt; cross-slope opers; residue mgmt.
...and ...ces	Alluvium over outwash	Loam	Very gravelly loam	Gravel	35-80 below 10"	10-20" over gravel	Moderately rapid	Very rapid	Good	Low	IVs	IVe	Droughtiness; erosion	Irrigation mgmt; cross-slope opers; residue mgmt.
...ces	Alluvium over outwash	Silt loam	Silty clay loam	Gravel	--	40-60" over gravel	Moderately slow	Very rapid	Good	Medium and high	IIIc	IIIe	Erosion; droughtiness	Cross-slope operations; residue mgmt; irrigation management
...and ...ces	Alluvium	Clay	Clay	None	--	60"+	Slow	Slow	Good	Medium	IIIc	IIIe	Clay; erosion	Subsurface tillage; cross-slope operations; residue management
...s	Alluvium over outwash	Loam	Loam	Sand and gravel	80 below 20-40"	20-40" over sand and gravel	Moderate	Very rapid	Poor	Low and medium	IVw	IVw	Wetness	Drainage; flood protection
...ces	Sand	Loamy fine sand	Fine sand	None	--	60"+	Very rapid	Very rapid	Excessive	Low	VIIe	IVe,VIe VIs	Erosion; droughtiness	Residue mgmt; irrigation management
...ds	Loess	Fine sandy loam	Fine sandy loam	None	--	60"+	Moderately rapid	Moderately slow to moderately rapid	Good & somewhat excessive	Medium	IVe IVc VIe VIIe	I IIe IIIe IVe	Erosion; strongly alkaline below 30"; droughtiness	Cross-slope operations; residue mgmt; irrigation mgmt; cropping sequence
...ces	Loess over basic igneous rock	Silt loam	Silt loam	None	--	20-30" over hardpan	Moderate	Impervious	Good	Low and medium	IVe	IIs	Erosion; hardpan at 20-30" deep; droughtiness	Subsurface tillage; cross-slope operations; irrigation mgmt; cropping sequence
...ds	Loess and basic igneous rock	Stony silt loam	Stony silt loam	Cobbles and stones	20-35 in profile	10-20" over bedrock	Moderate	Impervious	Good and somewhat excessive	Low	VIIs	IVe,IVs VIe,VIs	Shall over bedrock; stony profile	Rangeland management

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Table 135 - Continued

Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permea[bility] Sub[soil]
	8	1,500-3,000	11-15	120-160	Cropland (cereals)-dryland	Calcic Argixerolls	Fine-silty, mixed, mesic	Bagdad	50	Uplands	Loess	Silt loam	Silt loam	None	--	40-60" over bedrock	Modera
					Rangeland	Typic Haploxerolls	Coarse-loamy, mixed, mesic	Anders	10	Uplands	Loess over basic igneous rock	Silt loam	Silt loam	None	--	20-40" over bedrock	Modera
						Calcic Haploxerolls	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Benge	10	Terraces	Glacial outwash	Gravelly silt loam	Gravelly silt loam	Gravel	20-35 in profile; 60 below 20-40"	20-40" over gravel	Modera
						Cumulic Haploxerolls	Coarse-silty, mixed, mesic	Hermiston	10	Flood plains	Alluvium	Silt loam to very fine sandy loam	Silt loam to very fine sandy loam	None	--	60"+	Modera
						Calcic Lithic Haploxerolls	Loamy, mixed, mesic	Kuhl	3	Uplands (side slopes)	Loess and basic igneous rock	Very stony silt loam	Very stony silt loam	Cobbles and stones	35-80 in profile	10-20" over bedrock	Modera
	9	600-2,500	12-15	140-155	Cropland (cereals)-dryland	Typic Haploxerolls	Coarse-silty, mixed, mesic	Walla Walla	55	Uplands	Loess	Silt loam	Silt loam	None	--	60"+	Modera
					Rangeland	Calcic Haploxerolls (Calcic Pachic)	Coarse-loamy, mixed, mesic	Chard	20	Terraces	Loess and glacial material	Silt loam	Loam	None	--	40-60" over sand	Modera
						Calcic Haploxerolls	Fine-loamy, mixed, mesic	Asotin	5	Uplands (plateau tops and side slopes)	Loess over basic igneous rock	Silt loam	Silt loam	Gravel and cobbles	0-20 in profile	20-40" over bedrock	Modera
						Cumulic Haploxerolls	Coarse-silty, mixed, mesic	Hermiston	5	Flood plains	Alluvium	Silt loam and very fine sandy loam	Silt loam & very fine sandy loam	None	--	60"+	Modera
						Calcic Lithic Haploxerolls	Loamy, mixed, mesic	Kuhl	5	Uplands (side slopes)	Loess and basic igneous rock	Very stony silt loam	Very stony silt loam	Cobbles and stones	35-80 in profile	10-20" over bedrock	Modera

Table 135 - Continued

[cut off]ition on [cut off]andscape	Soil Characteristics: Parent Material	Soil Characteristics: Texture Surface Soil	Soil Characteristics: Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Soil Characteristics: Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass 6/: Dryland	Range of: Major Capability Subclass 6/: Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
[cut off]plands	Loess	Silt loam	Silt loam	None	--	40-60" over bedrock	Moderate	Impervious	Good	Medium and high	IIIe,IIIc IVe VIe	IIe IIIe IVe	Erosion; calcareous & strongly alkaline below 28"	Residue mgmt; cross-slope operations; cropping sequence
[cut off]plands	Loess over basic igneous rock	Silt loam	Silt loam	None	--	20-40" over bedrock	Moderate	Impervious	Good	Low and medium	IIIe IIIs IVe VIIs	IIIs IIIe IVe	Erosion; moderately deep over bedrock; droughtiness	Cross-slope operations; residue management; cropping sequence; irrigation management
[cut off]erraces	Glacial outwash	Gravelly silt loam	Gravelly silt loam	Gravel	20-35 in profile; 60 below 20-40"	20-40" over gravel	Moderate	Very rapid	Good	Low	IIIe,IIIc IVe, VIe VIIs	IIIe IIIs IVe	Droughtiness; gravelly profile	Rangeland mgmt; residue mgmt; irrigation mgmt; cropping sequence
[cut off]lood [cut off]lains	Alluvium	Silt loam to very fine sandy loam	Silt loam to very fine sandy loam	None	--	60"+	Moderate	Moderate	Good & moderately good	High	IIc	I	Calcareous and strongly alkaline below 24"	Irrigation management; cropping sequence
[cut off]plands [cut off](side [cut off]lopes)	Loess and basic igneous rock	Very stony silt loam	Very stony silt loam	Cobbles and stones	35-80 in profile	10-20" over bedrock	Moderate	Impervious	Good	Low	VIs	--	Shallow over bedrock; stony profile; steep slopes	Rangeland management
[cut off]plands	Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IIe,IIIe IVe, VIe VIIe	--	Erosion	Cross-slope operations; residue mgmt; irrigation mgmt; cropping sequence
[cut off]erraces	Loess and glacial material	Silt loam	Loam	None	--	40-60" over sand	Moderate	Very rapid	Good	Medium	IIc IIIe VIe	--	Erosion and droughtiness	Cross-slope operations; residue mgmt; irrigation mgmt; cropping sequence
[cut off]plands (plateau [cut off]ops and [cut off]ide slopes)	Loess over basic igneous rock	Silt loam	Silt loam	Gravel and cobbles	0-20 in profile	20-40" over bedrock	Moderate	Impervious	Good	Low and medium	IIIs IVe VIe VIIe	--	Erosion; moderately deep over bedrock; strongly alkaline & calcareous below 20"	Cross-slope operations; residue mgmt; cropping sequence
[cut off]lood [cut off]lains	Alluvium	Silt loam and very fine sandy loam	Silt loam & very fine sandy loam	None	--	60"+	Moderate	Moderate	Good & moderately good	High	IIc IIIc	I	Droughtiness	Irrigation mgmt; cropping sequence
[cut off]plands (side [cut off]lopes)	Loess and basic igneous rock	Very stony silt loam	Very stony silt loam	Cobbles and stones	35-80 in profile	10-20" over bedrock	Moderate	Impervious	Good	Low	VIIs	--	Shallow over bedrock; stony profile; steep slopes	Rangeland management

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Table 135 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Perme[a] Sub
	10	800-1,400	9-12	145-170	Cropland (cereals)-dryland Rangeland	Calciorthidic Haploxerolls	Coarse-silty, mixed, mesic	Ritzville	50	Uplands	Loess	Silt loam to very fine sandy loam	Silt loam to very fine sandy loam	None	--	60"+	Modera
						Calciorthidic Haploxerolls	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Magallon	10	Terraces	Alluvium over glacial outwash	Fine sandy loam to silt loam	Very fine sandy loam	Coarse sand	10-35 in profile	20-60" over bedrock	Modera modera rapid
						Torrifluventic Haploxerolls	Coarse-silty, mixed, mesic	Esquatzel	10	Flood plains	Alluvium	Silt loam to very fine sandy loam	Silt loam to very fine sandy loam	None	--	60"+	Modera
						Calciorthidic Haploxerolls	Coarse-silty, mixed, mesic	Ritzcal	10	Uplands (upper side slopes)	Loess (calcareous)	Silt loam to very fine sandy loam	Silt loam to very fine sandy loam	None	--	60"+	Modera
						Lithic Xerollic Camborthids	Loamy, mixed, mesic	Starbuck	5	Uplands	Loess and basic igneous rock	Stony silt loam	Stony silt loam	Cobbles and stones	20-35 in profile	10-20" over bedrock	Modera
Very deep soils with sandy and loamy profiles and cold winters on gentle to strong slopes.	11	2,700-2,900	15-20	120-160	Cropland (cereals, green peas, dry peas, grass seed, and alfalfa)-dryland and irrigated	Pachic Haploxerolls	Coarse-loamy, mixed, mesic	Imbler	40	Uplands	Sand	Sandy loam and coarse sandy loam	Sandy loam	None	--	60"+	Very r
						Pachic Haploxerolls	Fine-loamy, mixed, mesic	Alicel	35	Uplands	Loess	Loam and sandy loam	Clay loam	None	--	60"+	Moderat slow
						Typic Haploxerolls	Fine-silty, mixed, mesic	Palouse	25	Uplands	Loess	Silt loam	Silt loam	None	--	60"+	Moderat

Table 135 - Continued

Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass 6/ Dryland	Range of: Major Capability Subclass 6/ Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
	Soil Characteristics								Soil Qualities and Interpretations					
Uplands	Loess	Silt loam to very fine sandy loam	Silt loam to very fine sandy loam	None	--	60"+	Moderate	Moderate	Good and somewhat excessive	High	IIIe IVe VIe	I, IIe IIIe IVe	Erosion; free lime below 30"; droughtiness	Cross-slope operations; residue mgmt; irrigation mgmt; cropping sequence
Terraces	Alluvium over glacial outwash	Fine sandy loam to silt loam	Very fine sandy loam	Coarse sand	10-35 in profile	20-60" over bedrock	Moderate & moderately rapid	Impervious	Good and somewhat excessive	Low and medium	IVe VIe	IIs, IIIe IVe	Erosion; moderately deep and deep over bedrock; droughtiness	Cross-slope operations; residue mgmt; irrigation mgmt; cropping sequence
Flood plains	Alluvium	Silt loam to very fine sandy loam	Silt loam to very fine sandy loam	None	--	60"+	Moderate	Moderate	Good	High	IIIc IIIe	I IIe	Erosion and droughtiness	Residue mgmt; irrigation mgmt; cropping sequence
Uplands (upper side slopes)	Loess (calcareous)	Silt loam to very fine sandy loam	Silt loam to very fine sandy loam	None	--	60"+	Moderate	Moderate	Good and somewhat excessive	Medium	IVe VIe	--	Erosion; strongly calcareous below 10"	Permanent cover; cropping sequence
Uplands	Loess and basic igneous rock	Stony silt loam	Stony silt loam	Cobbles and stones	20-35 in profile	10-20" over bedrock	Moderate	Impervious	Good and somewhat excessive	Low	VIIs	--	Shallow over bedrock; stony profile	Rangeland management
Uplands	*Sand*	*Sandy loam and coarse sandy loam*	*Sandy loam*	*None*	--	60"+	*Very rapid*	*Very rapid*	*Good*	*Low*	*IIIe*	*IIe*	Erosion; droughtiness	Residue mgmt; irrigation management
Uplands	Loess	Loam and sandy loam	Clay loam	None	--	60"+	*Moderately slow*	*Moderately slow*	*Good*	*High*	IIe	IIe	Erosion	Residue mgmt; cross-slope operations; cropping sequence
Uplands	Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IIe	IIe	Erosion	Residue mgmt; cross-slope operations; cropping sequence

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	Soil Association					Classification					Soil Characteristics							
Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season	Major land use	Great Group or Subgroup	Family	Series 2/	Percentage 3/ of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth	Permeability Subsoil	Pe
Very deep to moderately deep soils with silty profiles and cold winters on gentle to steep slopes.	12	2,000-4,500	18-24	90-160	Cropland (cereals, peas, lentils and grass seed)-dryland	Typic Argixerolls	Fine-silty, mixed, mesic	Naff	30	Uplands	Loess	Silt loam	Silty clay loam	None	--	60"+	Moderately slow	Mo mo sl
					Rangeland	Typic Haploxerolls	Fine-silty, mixed, mesic	Palouse	30	Uplands	Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Mo mo sl
						Pachic Argixerolls	Fine-loamy, mixed, mesic	Waha	20	Uplands (plateau tops and side slopes)	Loess and basic igneous rock	Silt loam	Silty clay loam	None	--	20-40" over bedrock	Moderately slow	Im
						Lithic Argixerolls	Loamy-skeletal, mixed, mesic	Gwin	10	Uplands (side slopes)	Loess and basic igneous rock	Very stony silt loam	Very stony silty clay loam	Cobbles and stones	35-80 in profile	10-20" over bedrock	Moderately slow	Im
						Cumulic Haploxerolls (Haplaquolls)	Fine-silty, mixed, mesic	Caldwell	3	Flood plains	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderately slow	Mo sl im
						Mollic Haploxeralfs	Fine, montmorillonitic, mesic	Garfield	3	Uplands (ridgetops)	Loess	Silty clay loam or silty clay	Silty clay loam or silty clay	None	--	60"+	Moderately slow or slow	Mo sl sl
	13	1,850-3,400	15-18	110-145	Cropland (cereals, peas and grass seed)-dryland	Typic Haploxerolls	Fine-silty, mixed, mesic	Athena	50	Uplands	Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Mo
					Rangeland	Calcic Argixerolls (Pachic)	Fine-silty, mixed, mesic	Pataha	20	Uplands (plateau tops and side slopes)	Loess and basic igneous rock	Silt loam	Silt loam	None	--	20-40" over bedrock	Moderate	Im
						Lithic Argixerolls	Loamy-skeletal, mixed, mesic	Gwin	10	Uplands (side slopes)	Loess and basic igneous rock	Very stony silt loam	Very stony, silty clay loam	Cobbles and stones	35-80 in profile	10-20" over bedrock	Moderately slow	Im
						Cumulic Haploxerolls	Coarse-silty, mixed, mesic	Mondovi	3	Flood plains	Alluvium	Silt loam	Silt loam	None	--	60"+	Moderate	Mo im
						Typic Xerorthents	Fine-silty, mixed, calcareous, mesic	Lance	3	Uplands (ridgetops)	Loess and lacustrine material	Silt loam	Silt loam (laminated)	None	--	60"+	Moderately slow	Mo sl

Table 135 - Continued

ion on iscape	Soil Characteristics						Soil Qualities and Interpretations							
	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments		Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass		Major Soil Problems	Suitable Land Treatment and Structures
				Kind	Percent						Dryland	Irrigated 6/		
ands	Loess	Silt loam	Silty clay loam	None	--	60"+	Moderately slow	Moderate and moderately slow	Good	High	IIe,IIIe IVe VIe	--	Erosion	Cross-slope operations; residue mgmt; cropping sequence
ands	Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate and moderately slow	Good	High	IIe,IIIe IVe VIe	--	Erosion	Cross-slope operations; residue mgmt; cropping sequence
ands ateau s and e slopes)	Loess and basic igneous rock	Silt loam	Silty clay loam	None	--	20-40" over bedrock	Moderately slow	Impervious	Good	Low and medium	IIIe IVe VIe	--	Erosion; moderately deep over bedrock	Residue mgmt; cross-slope operations; cropping sequence
ands de pes)	Loess and basic igneous rock	Very stony silt loam	Very stony silty clay loam	Cobbles and stones	35-80 in profile	10-20" over bedrock	Moderately slow	Impervious	Good	Low	VIs VIIs	--	Shallow over bedrock; stony profile; steep slopes	Rangeland management
od ins	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderately slow	Moderately slow or impervious	Somewhat poor	High	IIw	--	High seasonal water table	Drainage; cropping sequence
ands dgetops)	Loess	Silty clay loam or silty clay	Silty clay loam or silty clay	None	--	60"+	Moderately slow or slow	Moderately slow or slow	Good	Medium and high	IVe VIe	--	Erosion; clayey profile	Permanent cover; cropping sequence
ands	Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IIe,IIIe IVe VIe	--	Erosion; free lime below 30" in some areas	Cross-slope operations; residue mgmt; cropping sequence
ands ateau s and e slopes)	Loess and basic igneous rock	Silt loam	Silt loam	None	--	20-40" over bedrock	Moderate	Impervious	Good	Low and medium	IIIe,IVe VIe	--	Erosion; moderately deep over bedrock	Cross-slope operations; residue mgmt; cropping sequence
ands de pes)	Loess and basic igneous rock	Very stony silt loam	Very stony, silty clay loam	Cobbles and stones	35-80 in profile	10-20" over bedrock	Moderately slow	Impervious	Good	Low	VIs VIIs	--	Shallow over bedrock; stony profile; steep slopes	Rangeland management
od ins	Alluvium	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate or impervious	Moderately good	High	IIc	--	Frost hazard	Residue mgmt; cropping sequence
ands dgetops)	Loess and lacustrine material	Silt loam	Silt loam (laminated)	None	--	60"+	Moderately slow	Moderately slow	Good	Low and medium	IVe VIe	--	Erosion; calcareous laminated profile	Permanent cover; cropping sequence

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Table 135 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permea[bility] Subs[oil]
	14	3,000-4,000	18-22	80-135	Cropland (cereals, peas, clover, hay and pasture) - dryland	Abruptic Palexerolls (Paleudolls)	Fine, montmorillonitic, mesic	Nez Perce	50	Uplands (long gentle south slopes)	Loess	Silt loam	Silty clay	None	--	10-20" over clayey material	Slow
					Rangeland	Typic Argixerolls	Fine-loamy, mixed, mesic		25	Uplands (moderate north slopes)	Loess	Silt loam	Silty clay loam	None	--	60"+	Moderat[e] slow
						Chromic Pellixererts	Fine, montmorillonitic, mesic		10	Uplands (ridgetops)	Loess	Silty clay loam	Silty clay	None	--	60"+	Slow
						Typic Argixerolls	Clayey-skeletal, montmorillonitic, mesic		5	Uplands	Loess and basic igneous rock	Silt loam	Extremely stony silty clay	Cobbles and stones	35-80 below 10"	20-40" over bedrock	Slow
						Cumulic Haploxerolls (Haplaquolls)	Fine-silty, mixed, mesic	Caldwell	2	Flood plains	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderate slow
	15	2,500-4,000	22-26	60-120	Cropland (cereals, peas, hay and pasture)-dryland	Ultic Argixerolls	Fine-silty, mixed, mesic	Larkin	45	Uplands	Loess	Silt loam	Silty clay loam	None	--	60"+	Moderate slow
					Forest land[4/]	Boralfic Argixerolls	Fine-silty, mixed, mesic	Southwick	25	Uplands	Loess	Silt loam	Silty clay loam	None	--	20-40" over silty clay	Moderate[ly] slow
						Lithic Argiudolls (Argixerolls)	Loamy-skeletal, mixed, mesic	Lacy	10	Uplands (canyon side slopes)	Loess and basic igneous rock	Stony loam	Extremely stony clay loam	Cobbles and stones	35-80 in profile	10-20" over bedrock	Moderate[ly] slow
						Aquollic Hapludalfs	Fine-silty, mixed, mesic	Lovell	5	Flood plains	Alluvium	Silt loam	Silty clay loam	None	--	10-20" over clayey material	Moderate[ly] slow

	Soil Characteristics					Soil Qualities and Interpretations							
			Coarse Fragments						Total Available Water-holding	Range of: Major Capability Subclass			
nt ial	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Capacity	Dryland	Irrigated[6/]	Major Soil Problems	Suitable Land Treatment and Structures
s	Silt loam	Silty clay	None	--	10-20" over clayey material	Slow	Slow	Moderately good	Medium	IIe IIIe	--	Erosion; silty clay subsoil moderately restricts roots and water below 20"	Subsurface tillage; cross-slope operations; residue mgmt; cropping sequence
s	Silt loam	Silty clay loam	None	--	60"+	Moderately slow	Moderately slow	Good	High	IIe,IIIe IVe VIe	--	Erosion; acid soil	Cross-slope operations; residue mgmt; cropping sequence
is	Silty clay loam	Silty clay	None	--	60"+	Slow	Slow	Moderately good	Medium	IIIs VIIs	--	Silty clay subsoil restricts roots & water; erosion	Cover crop; cropping sequence
ss and ic igus rock	Silt loam	Extremely stony silty clay	Cobbles and stones	35-80 below 10"	20-40" over bedrock	Slow	Impervious	Good	Low	IIIe,IVe VIe,VIs VIIs	--	Moderately deep over bedrock; stony profile	Rangeland management; cross-slope operations; residue mgmt; cropping sequence
uvium	Silt loam	Silty clay loam	None	--	60"+	Moderately slow	Moderately slow or impervious	Somewhat poor	High	IIw	--	High seasonal water table	Drainage; cropping sequence
ess	Silt loam	Silty clay loam	None	--	60"+	Moderately slow	Moderate & moderately slow	Good	High	IVe IIIe VIe	--	Erosion	Cross-slope operations; residue mgmt; cropping sequence
ess	Silt loam	Silty clay loam	None	--	20-40" over silty clay	Moderately slow	Slow	Moderately good	Medium & high	IIIe IVe VIe	--	Erosion; silty clay substratum restricts roots and water	Subsurface tillage; cross-slope operations; residue management; cropping sequence
ess and sic igeous rock	Stony loam	Extremely stony clay loam	Cobbles and stones	35-80 in profile	10-20" over bedrock	Moderately slow	Impervious	Good	Low	VIs VIIs	--	Shallow over bedrock; stony profile	Rangeland management
lluvium	Silt loam	Silty clay loam	None	--	10-20" over clayey material	Moderately slow	Slow	Somewhat poor	Medium and high	IIw	--	High seasonal water table; clayey substratum	Drainage; subsurface tillage; cropping sequence

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Table 135 - Continued

Soil Association: Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Chrracteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeability Subsoil
Very deep to moderately deep frigid soils with silty profiles on gentle to very steep slopes.	16	2,800-5,000	25-35	60-100	Forest land Cropland (cereals, hay & pasture) - dryland	Typic Fragiochrepts	Fine-silty, mixed, frigid	Santa	25	Uplands	Loess	Silt loam	Silty clay	None	--	20-40" over clay	Moderately slow
						Alfic Cryic Fragiorthods	Fine-silty, mixed, frigid	Helmer	20	Uplands	Volcanic ash and loess	Silt loam	Silt loam	None	--	40-60" over bedrock	Moderate
						Glossoboralfic Argiudolls	Fine, montmorillonitic, mesic	Kooskia	15	Uplands	Loess	Silt loam	Silt loam	None	--	60"+	Moderate
						Typic Argixerolls	Fine-loamy, mixed, frigid	Klicker	15	Uplands (ridgetops and side slopes)	Loess and basic igneous rock	Silt loam	Stony silty clay loam	Cobbles and stones	20-35 below 10"	20-40" below bedrock	Moderately slow
						Aquollic Hapludalfs	Fine, montmorillonitic, mesic	Potlatch	5	Flood plains	Alluvium	Silt loam	Clay	None	--	10-20" over clay	Very slow
						Abruptic Cryoborolls (Argiborolls)	Fine, montmorillonitic	Boles	2	Uplands	Loess	Silt loam	Silty clay	None	--	10-20" over clay	Slow
Shallow to moderately deep, rocky soils with loamy subsoils on moderate to extremely steep slopes.	17	300-3,000	8-28	120-200	Rangeland Cropland (cereals, hay, fruit orchards, truck crops & pasture)-some irrigation	Lithic Haploxerolls	Loamy, mixed, mesic	Kuhl	40	Uplands (side slopes)	Loess and basic igneous rock	Very stony silt loam	Very stony silt loam	Cobbles and stones	35-80 in profile	10-20" over bedrock	Moderate
						Pachic Argixerolls	Fine-loamy, mixed, mesic	Linville	20	Uplands (side slopes)	Loess and basic igneous rock	Silt loam	Silt loam	Cobbles and stones	5-20 in profile	40-60" over bedrock	Moderate
						Calciorthidic Haploxerolls	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Magallon	10	Terraces	Alluvium over glacial outwash	Very fine sandy loam	Very fine sandy loam	Gravel and sand	35-60 below 20"	20-40" over stratified sand, gravel and silt	Moderate
						Typic Haploxerolls	Coarse-silty, mixed, mesic	Walla Walla	10	Uplands & terraces	Loess	Silt loam	Silt loam	None	--	60"+	Moderate

Table 135 - Continued

	Soil Chrracteristics						Soil Qualities and Interpretations							
				Coarse Fragments						Total Available Water-holding Capacity	Range of: Major Capability Subclass			
e	Parent Material	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class		Dryland	Irrigated[6]	Major Soil Problems	Suitable Land Treatment and Structures
	Loess	Silt loam	Silty clay	None	--	20-40" over clay	Moderately slow	Very slow	Moderately good	High	IVe VIe	--	Erosion; moderately deep over clay; acid soil	Forest land mgmt; cross-slope opers; residue mgmt; subsurface tillage; cropping sequence
	Volcanic ash and loess	Silt loam	Silt loam	None	--	40-60" over bedrock	Moderate	Impervious	Good	Medium to high	IIIe IVe VIe	--	Erosion; mostly volcanic ash	Forest land mgmt; cross-slope opers; residue mgmt; cropping sequence
	Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IVe VIe	--	Erosion; acid soil	Forest land mgmt; cross-slope opers; residue mgmt; cropping sequence
ops le	Loess and basic igneous rock	Silt loam	Stony silty clay loam	Cobbles and stones	20-35 below 10"	20-40" below bedrock	Moderately slow	Impervious	Good	Low	VIs VIIs	--	Moderately deep over bedrock; stony profile; steep slopes	Forest land and rangeland management
	Alluvium	Silt loam	Clay	None	--	10-20" over clay	Very slow	Very slow	Somewhat poor	High	IVw	--	Clay subsoil restricts roots and water at 15" depths; acid soil	Drainage; subsurface tillage; cropping sequence
s	Loess	Silt loam	Silty clay	None	--	10-20" over clay	Slow	Slow	Moderately good	High	IVe VIe	--	Silty clay subsoil restricts roots and water at 20" depths; acid soil	Cross-slope operations; residue mgmt; cropping sequence; subsurface tillage
s)	Loess and basic igneous rock	Very stony silt loam	Very stony silt loam	Cobbles and stones	35-80 in profile	10-20" over bedrock	Moderate	Impervious	Good	Low	VIIs	--	Shallow over bedrock; stony profile; steep slopes	Rangeland management
is i)	Loess and basic igneous rock	Silt loam	Silt loam	Cobbles and stones	5-20 in profile	40-60" over bedrock	Moderate	Impervious	Good	Medium and high	VIIe	--	Erosion; steep slopes; cobbly and stony profile	Rangeland management
tes	Alluvium over glacial outwash	Very fine sandy loam	Very fine sandy loam	Gravel and sand	35-60 below 20"	20-40" over stratified sand, gravel and silt	Moderate	Rapid	Good and somewhat excessive	Low and medium	IVe VIe VIIe VIIs	IIIe VIs	Erosion; moderately deep over gravel & sand;droughtiness	Cross-slope operations; residue mgmt; irrigation management; cropping sequence
ds & ces	Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IIe, IIIe IVe VIe	I,IIIe IIIs IVe	Erosion	Cross-slope operations; residue mgmt; irrigation mgmt; cropping sequence

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Table 135 - Continued

Soil Association						Classification			Percentage of Assn. [3]	Position on Landscape	Soil Characteristics					
Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series [2]			Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth
	18	750-3,000	11-18	120-170	Rangeland Cropland (cereals)-dryland, (fruit orchards and vegetables)-irrigated	Calcic Haploxerolls	Fine-loamy, mixed, mesic	Asotin	45	Uplands (plateau tops and side slopes)	Loess over basic igneous rock	Silt loam	Silt loam	Cobbles and gravel	0-20 in profile	20-40" over bedrock
						Calcic Lithic Haploxerolls	Loamy, mixed, mesic	Kuhl	20	Uplands (side slopes)	Loess and basic igneous rock	Very stony silt loam	Very stony silt loam	Cobbles and stones	35-80 in profile	10-20" over bedrock
						Typic Haploxerolls	Fine-silty, mixed, mesic	Athena	10	Uplands	Loess	Silt loam	Silt loam	None	--	60"+
						Calcic Entic Haploxerolls	*Loamy-skeletal*, mixed, mesic	Alpowa	10	Uplands (lower side slopes)	Loess and basic igneous rock	Very stony silt loam	Cobbly silt loam	Stones, cobbles & gravel	20-35 in profile	20-60" over bedrock
						--	--	*Rockland* [5]	5	Uplands	Basic igneous rock	--	--	--	--	10-20" over bedrock
Moderately deep to shallow soils with silty and cobbly subsoils and cold winters on moderate to steep slopes.	19	1,500-3,500	17-22	120-170	Cropland (cereals, grass, green peas, fruit orchards and pasture)-dryland	Lithic Argixerolls	Loamy-skeletal, mixed, mesic	Rock Creek	35	Uplands (ridgetops)	Loess and basic igneous rock	Stony loam to stony silty clay loam	Stony loam to stony silty *clay* loam	Cobbles and stones	20-35 in profile	10-20" over bedrock
					Rangeland	Pachic Argixerolls	Fine-loamy, mixed, mesic	Waha	30	Uplands (plateau tops and side slopes)	Loess and basic igneous rock	Silt loam and silty clay loam	Clay loam & silty clay loam	None	--	20-40" over bedrock
					Forest land	Typic Haploxerolls	Fine-silty, mixed, mesic	Palouse	10	Uplands	Loess	Silt loam	Silt loam	None	--	40-60" over bedrock
						Typic Vitrandepts	Ashy over loamy, mixed, frigid	Tolo	10	Uplands	Volcanic ash	Silt loam	Silt loam	None	--	20-60" over bedrock
						Typic Argixerolls	Fine-loamy, mixed, frigid	Klicker	10	Uplands	Loess and basic igneous rock	Silt loam	Stony silty clay loam	Cobbles and stones	20-35 below 10"	20-40" over bedrock
	20	4,000-6,000	*16-30*	*60-110*	*Forest land* [4] Rangeland	*Argixerolls* plus Xerorthents (shallow), Xeralfs & Rockland	*Fine-loamy and* loamy-skeletal, mixed, frigid	--	100	Upland (steep slopes)	Loess and basic igneous rock	--	--	--	--	20-40" over bedrock

...pe	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass Dryland	Range of: Major Capability Subclass Irrigated[6]	Major Soil Problems	Suitable Land Treatment and Structures
...u ...d ...opes)	Loess over basic igneous rock	Silt loam	Silt loam	Cobbles and gravel	0-20 in profile	20-40" over bedrock	Moderate	Impervious	Good	Low and medium	IIIe IVe VIe VIIe	--	Erosion; moderately deep over bedrock; strongly alkaline and calcareous below 20"	Cross-slope operations; residue mgmt; cropping sequence
	Loess and basic igneous rock	Very stony silt loam	Very stony silt loam	Cobbles and stones	35-80 in profile	10-20" over bedrock	Moderate	Impervious	Good	Low	VIIs	--	Shallow over bedrock; stony profile; steep slopes	Rangeland management
	Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IIe,IIIe IVe VIIe	--	Erosion	Cross-slope operations; residue mgmt; cropping sequence
	Loess and basic igneous rock	Very stony silt loam	Cobbly silt loam	Stones, cobbles & gravel	20-35 in profile	20-60" over bedrock	Moderate	Impervious	Good	Low and medium	VIIs	--	Cobbly profile; steep slopes	Rangeland management
	Basic igneous rock	--	--	--	--	10-20" over bedrock	--	Impervious	Good	Low	VIIIs	--	Shallow over bedrock	--
...s	Loess and basic igneous rock	Stony loam to stony silty clay loam	Stony loam to stony silty clay loam	Cobbles and stones	20-35 in profile	10-20" over bedrock	Moderate and moderately slow	Impervious	Good	Low	VIIs	--	Shallow over bedrock; stony profile; steep slopes	Rangeland management
...s ...au ...nd ...)	Loess and basic igneous rock	Silt loam and silty clay loam	Clay loam & silty clay loam	None	--	20-40" over bedrock	Moderately slow	Impervious	Good	Low and medium	IVe	--	Erosion; moderately deep over bedrock	Cross-slope operations; residue mgmt; cropping sequence
...s	Loess	Silt loam	Silt loam	None	--	40-60" over bedrock	Moderate	Impervious & moderate	Good	Medium and high	IIIe	--	Erosion	Cross-slope operations; residue mgmt; cropping sequence
...s	Volcanic ash	Silt loam	Silt loam	None	--	20-60" over bedrock	Moderate	Impervious	Good	Low to high	IVe	--	Erosion; volcanic ash material	Cross-slope operations; residue mgmt; cropping sequence
...s	Loess and basic igneous rock	Silt loam	Stony silty clay loam	Cobbles and stones	20-35 below 10"	20-40" over bedrock	Moderately slow	Impervious	Good	Low	VIIs	--	Moderately deep over bedrock; stony profile; steep slopes	Forest land and rangeland management
...)	Loess and basic igneous rock	--	--	--	--	20-40" over bedrock	Moderately slow	Impervious	Good	Low	VIIs	--	Moderately deep over bedrock; stony profile; steep slopes	Forest land and rangeland management

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Table 135 - Continued

Soil Association: Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth
Moderately deep frigid soils with stony, silty and clayey subsoils on moderate to extremely steep slopes.	21	3,000-5,500	14-22	60-120	Rangeland Forest land[4/]	Ultic Haploxerolls	Fine-loamy, mixed, frigid	Hall Ranch	40	Uplands (south slopes)	Loess over basic igneous rock	Loam and stony loam	Stony silt loam	Cobbles and stones	20-35 in profile	20-40" over bedrock
					Cropland (hay, cereals & pasture)-dryland	Abruptic Palexerolls	Fine, montmorillonitic, frigid	Zumwalt	20	Uplands	Loess over basic igneous rock	Silt loam	Clay & stony clay	Cobbles and stones	10-35 in profile	20-60" over bedrock
						Typic Vitrandepts	Ashy over loamy, mixed, frigid	Tolo	15	Uplands (east and north slopes)	Volcanic ash	Silt loam	Silt loam	None	--	20-60" over bedrock
						Typic Argixerolls	Clayey-skeletal, mixed, frigid	Snell	10	Uplands (south slopes)	Loess and basic igneous rock	Stony silt loam	Very stony clay loam & stony clay	Cobbles and stones	35-80 in profile	20-40" over bedrock
						Argic Pachic Cryoborolls	Fine-silty, mixed		5	Uplands (north slopes) fans and basins	Loess over basic igneous rock	Silt loam and silty clay loam	Silt loam & silty clay loam	None	--	20-60" over bedrock
Shallow to deep frigid, ashy soils with loamy subsoils on moderate to very steep slopes.	22	3,000-7,500	22-50	20-130	Forest land[4/]	Vitrandepts plus Argixeralfs, Cryandepts and Haploxerolls	Ashy over loamy, mixed, and fine-loamy	--	100	Uplands	Volcanic ash, loess and basic igneous rock	--	--	--	--	10-60" over bedrock

Table 135 - Continued

	Soil Characteristics					Soil Qualities and Interpretations							
			Coarse Fragments						Total Available Water-holding	Range of: Major Capability Subclass			
t al	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Capacity	Dryland	Irrigated[6/]	Major Soil Problems	Suitable Land Treatment and Structures
over ig- rock	Loam and stony loam	Stony silt loam	Cobbles and stones	20-35 in profile	20-40" over bedrock	Moderate	Impervious	Good	Low	VIe	--	Stony profile and moderately deep over bedrock	Rangeland management
over ig- rock	Silt loam	Clay & stony clay	Cobbles and stones	10-35 in profile	20-60" over bedrock	Very slow	Impervious	Good	Low to high	IIIe	--	Erosion; clay subsoil restricts water & roots; stony profile	Cross-slope operations; residue mgmt; subsurface tillage; rangeland mgmt; cropping sequence
nic	Silt loam	Silt loam	None	--	20-60" over bedrock	Moderate	Impervious	Good	Low to high	IIIe	--	Erosion; volcanic ash material	Forest land management; residue mgmt; cross-slope operations; cropping sequence
and ig- rock	Stony silt loam	Very stony clay loam & stony clay	Cobbles and stones	35-80 in profile	20-40" over bedrock	Moderately slow	Impervious	Good	Low	VIIe	--	Stony profile and moderately deep over bedrock	Rangeland management
s over c ig- s rock	Silt loam and silty clay loam	Silt loam & silty clay loam	None	--	20-60" over bedrock	Moderate and moderately slow	Impervious	Good	Low to high	IIIe IVe	--	Erosion; moderately deep over bedrock	Cross-slope operations; cropping sequence
anic loess basic ous rock	--	--	--	--	10-60" over bedrock	Moderate	--	Good	Low to medium	VIe	--	Erosion; with improper use	Continued forest land mgmt; cropping sequence; cross-slope operations; residue mgmt and rangeland management

2

Table 135 - Continued

Soil Association						Classification					Soil Characteristics					
Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season	Major Land Use	Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth
	23	5,000-9,000	12-18	0-80	Rangeland Forest land[4]	Argiudic Cumulic Cryoborolls	Fine-loamy, mixed		20	Fans and flood plains	Volcanic material	Silt loam	Silty clay loam	None	--	40-60" over tuff or volcanic ash
					Cropland (hay and cereals)-irrigated	Argiudic Cumulic Cryoborolls	Loamy-skeletal, mixed		20	Uplands (mountain tops)	Volcanic material	Silt loam	Clay loam	None	--	20-40" over tuff
						Lithic Argixerolls	Loamy, mixed, frigid		10	Uplands (side slopes & *ridgetops*)	Acidic igneous rock	Stony loam	Rocky silty clay loam	Cobbles and stones	20-35 in profile	10-20" over bedrock
						Aridic Calcic Argixerolls	Fine-loamy, mixed, frigid	Concreek	10	Fans	Volcanic material	Silt loam	Clay loam	None	--	40-60" over tuff
						Calcic Argixerolls	Fine, montmorillonitic, frigid		10	Fans and terraces	Glacial outwash	Silt loam	Silty clay loam	Gravel and cobbles	60 below 20-60"	20-60" over gravel and cobbles
						Typic Argiustolls	Fine, montmorillonitic, frigid		10	Fans and terraces	Alluvium	Silt loam	Clay	None	--	40-60" over clayey material
Moderately deep to very deep frigid soils with loamy subsoils on moderate to extremely steep slopes.	24	5,000-10,000	15-30	0-80	Forest land[4] Rangeland	*Argixerolls* plus Xerorthents (shallow), Xeralfs and Rockland	*Fine-silty*, loamy-skeletal, frigid, mixed	--	100	Uplands gentle to steep slopes	Sedimentary rock (limestone)	--	--	--	--	10-40" over bedrock to 60"
Shallow, frigid rocky soils on extremely steep slopes.	25	6,000-12,000	18-60	None	Other Forest land[4] Rangeland	Rockland	--	--	10	Upland (steep mountains)	Sedimentary & igneous rock	--	--	--	--	10-60" over bedrock

Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass 6/: Dryland	Range of: Major Capability Subclass 6/: Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
	Soil Characteristics						Soil Qualities and Interpretations							
Fans and flood plains	Volcanic material	Silt loam	Silty clay loam	None	--	40-60" over tuff or volcanic ash	Moderately slow	Moderate to impervious	Good	Medium and high	IVe	--	Erosion	Rangeland management; residue mgmt; cross-slope operations; cropping sequence
Uplands (mountain tops)	Volcanic material	Silt loam	Clay loam	None	--	20-40" over tuff	Moderately slow	Impervious	Good	Low and medium	IVe VIe VIIs	--	Erosion; moderately deep over tuff	Rangeland and forest land mgmt; cropping sequence
Uplands (side slopes & ridgetops)	Acidic igneous rock	Stony loam	Rocky silty clay loam	Cobbles and stones	20-35 in profile	10-20" over bedrock	Moderately slow	Impervious	Good	Low	VIe,VIs VIIs	--	Shallow over bedrock; stony profile	Rangeland and forest land mgmt.
Fans	Volcanic material	Silt loam	Clay loam	None	--	40-60" over tuff	Moderately slow	Impervious	Good	Medium and high	IVe	--	Erosion	Rangeland management; cropping sequence
Fans and terraces	Glacial outwash	Silt loam	Silty clay loam	Gravel and cobbles	60 below 20-60"	20-60" over gravel and cobbles	Moderately slow	Very rapid	Good	Low to high	IVe VIs VIIs	--	Erosion; moderately deep and deep over gravel and cobble	Rangeland management; cropping sequence
Fans and terraces	Alluvium	Silt loam	Clay	None	--	40-60" over clayey material	Slow	Slow	Good	Medium and high	IVe	--	Erosion; clay subsoil	Rangeland management
Uplands gentle to steep slopes	Sedimentary rock (limestone)	--	--	--	--	10-40" over bedrock to 60"+	Moderately slow to moderate	--	Good	Medium	VIe VIs	--	Erosion with improper mgmt or heavy cover disturbance	Continued forest land and rangeland mgmt.
Upland (steep mountains)	Sedimentary & igneous rock	--	--	--	--	10-60" over bedrock	Moderate to impervious	--	Good	Medium	VIII	--	Shallow to moderately deep over bedrock; steep slopes; cold climate	Protection

2

Table 135 - Continued

Soil Association						Classification			Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics						
Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series[2/]			Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth	Permeability Subsoil
Deep, frigid soils with stony, loamy subsoils on moderate to very steep slopes.	26	3,000-9,000	25-60	0-80	Forest land[4/]	Cryandepts plus Cryochrepts and Cryorthods	Ashy coarse loamy-skeletal, mixed	--	100	Uplands (steep slopes)	Acidic igneous rock	--	--	--	--	40-60" over bedrock	Moderate rapid

1/ Based on data summarized during 1966.
2/ Only soil series names that have a status as reserved, tentative, or established are listed.
3/ Differences of total percentage in each soil association from 100 percent are inclusions of other soils and land types.
4/ For the upland forest soils, the above characteristics and qualities have been extended from a limited amount of survey data. Additional data and land use interpretations for forest soils are available in the Forest Land section of Appendix VIII, Land Measures and Watershed Protection. These areas include National Forest and adjacent non-Federal forest lands.
5/ Miscellaneous land types.
6/ Presently irrigated cropland.

Source: National Cooperative Soil Survey.

Table 135 - Continued

tion / h / sca	Soil Characteristics									Soil Qualities and Interpretations					
	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass 6/: Dryland	Range of: Major Capability Subclass 6/: Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
nds rp es)	Acidic igneous rock	--	--	--	--	40-60" over bedrock	Moderate to rapid '	Impervious	Good	Low and medium	VIe	--	Erosion with improper land use	Continued forest land management

and types.
of survey data.
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Table 136 - Soil Associations Acreage by States, Subregion 6, 1966

Soil Association Map Symbol	Soil Association Name	Oregon	Washington	Idaho	Total	Percent
		(1,000 acres)				
1	LaGrande-Veazie	160.0	-	-	160.0	.7
2	Archabal-Blackwell	-	-	115.2	115.2	0.5
3	Sagemoor-Hezel	-	84.6	-	84.6	0.5
4	Hesseltine-Benge	-	595.5	-	595.5	3.0
5	Gini-Ramshorn	-	-	716.8	716.8	3.0
6	Quincy	-	32.0	-	32.0	0.2
7	Adkins-Burke	-	32.0	-	32.0	0.2
8	Bagdad-Anders	-	16.0	-	16.0	0.1
9	Walla Walla-Chard	-	556.0	-	556.0	3.0
10	Ritzville-Magallon	-	210.4	-	210.4	1.0
11	Imbler-Alicel	25.6	-	-	25.6	0.1
12	Naff-Palouse	-	367.0	241.0	608.0	3.0
13	Athena-Pataha	-	778.4	8.0	786.4	4.0
14	Nez Perce	-	-	320.0	320.0	1.0
15	Larkin-Southwick	-	-	448.0	448.0	2.0
16	Santa-Helmer	-	-	531.2	531.2	2.0
17	Kuhl-Linville	324.2	340.0	1,063.8	1,728.0	8.0
18	Asotin-Kuhl	-	204.8	44.8	249.6	1.2
19	Rock Creek-Waha	160.0	-	-	160.0	1.0
20	Dominantly Argixerolls	-	-	768.0	768.0	3.0
21	Hall Ranch-Zumwalt	310.4	-	-	310.4	1.7
22	Dominantly Vitrandepts	1,852.0	292.0	-	2,144.0	9.0
23	Frigid soils	-	-	352.0	352.0	2.0
24	Dominantly Argixerolls	-	-	2,073.6	2,073.6	9.0
25	Rockland	336.0	-	1,507.2	1,843.2	8.0
26	Pyle-Graylock	-	-	7,504.7	7,504.7	33.0
	Total Land Area	3,168.2	3,508.7	15,694.3	22,371.2	100.0

Source: National Cooperative Soil Survey.

Interpretations and Evaluation

Table 137 relates the land capability classes to the Land Capability Map, figure 3. It must be realized that the Land Capability Map is highly generalized and a specific capability class on table 137 may not be shown. To determine the land capability of any particular area, refer to the soil association symbols listed in the second column of the table and then locate the area of that symbol on the Soil Association Map, figure 27. Table 187 also shows the acreage and extent of the dominant land capability class for practical segments of the landscape.

Classified on table 138 is the dominant water storage capacity for each soil association in Subregion 6. Each class on the table relates to a similar class on the regional map on Water Storage Capacity, figure 4. To locate those areas having contrasting water storage capacity in the upper 5 feet of soil, refer to figure 4, to figure 27 (the subregional Soil Association Map), and to the following table. The class letter symbol in the first column and the Soil Association Map numerical symbol listed in the second column may be used to locate those areas having contrasting water storage capacity. Complete utilization of this storage contributes a more stable and sustained streamflow.

Table 137 - Summary and Distribution of Land Capability Classes, Subregion 6, 1966

Land Capability Classes	Distribution by Soil Associations 1/ Soil Association Map Symbols 2/	1,000 Acres	Percent	Inventoried 1,000 Acres 3/
Class I - Soils in Class I have no limitations or hazards. They are adopted to all uses with a minimum of conservation treatment other than standard conditioning cnes. 4/	-	-	-	3.0
Class II - Soils in Class II have few limitations or hazards. Simple conservation practices are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	1	160.0	.7	424.1
Class III - Soils in Class III have more limitations and hazards than those in Class II. They require more difficult or complex conservation practices when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	5-8-9-10-11 12-13-14-15-18	3,936.8	17.6	2,497.4
Class IV - Soils in Class IV have greater limitations and hazards than Class III. Still more difficult or complex measures are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	2-3-4-7 16-19-21	1,828.9	8.2	933.4
Class V - Soils in Class V have more limitations than Class IV. They are generally unsuited for cultivation, but are well suited for grazing and forestry use. They require good management practices. 4/	-	-	-	12.0
Class VI - Soils in Class VI have severe limitations or hazards that make them generally unsuited for cultivation. They are suited largely to pasture, range, woodland or wildlife.	20-22-23-24-26	12,842.3	57.4	14,403.9
Class VII - Soils in Class VII have very severe limitations and hazards that make them generally unsuited for cultivation. They are suited to grazing, noncommercial, woodland or wildlife.	6-17	1,760.0	7.9	3,316.3
Class VIII - Soils and land forms in Class VIII have limitations and hazards that prevent their use for cultivated crops, pasture, range or woodland. They may be used for recreation, wildlife or water supply.	25	1,843.2	8.2	781.1
Total Land	-	22,371.2	100.0	22,371.2

1/ Class I and 10 percent of other capability classes may be included in areas of Class II. Up to 25 percent of other capability classes may be included in Classes III and IV. Class V and up to 40 percent of other capability classes may be included in Classes VI, VII, and VIII. In areas of rainfall less than 12 inches, large areas of Class VI can be potential Classes I through IV where irrigation water is available.
2/ Refer to the Subregional Soil Association Map, figure 27.
3/ Taken from table 8.
4/ Capability Classes I and V are distributed in small segregated areas over segments of the landscape. Many small areas could not be delineated on the map. This added detail, although still generalized, is commensurate with the subregional level of generalization.
Source: National Cooperative Soil Survey and U.S.D.A. Conservation Needs Inventory adjusted.

Table 138 - Water Storage Capacity of Soils Generalized to the Soil Associations, Subregion 6, 1966

Classes of Water Storage Capacity 1/	Soil Association Symbols	1,000 Acres	Percent
Class A - Water storage in the soil profile more than 20,000 acre-feet per township.	1-8-9-10-12 13-14-15-16	3,636.0	16.3
Class B - Water storage in the soil profile 10,000 to 20,000 acre-feet per township.	2-17-18 19-21-22-24	6,780.8	30.3
Class C - Water storage in the soil profile 5,000 to 10,000 acre-feet per township.	3-4-5-7 11-23-20-26	10,079.2	45.0
Class D - Water storage in the soil profile less than 5,000 acre-feet per township.	6-25	1,875.2	8.4
Total		22,371.2	100.0

1/ Measurement of the water storage capacity is limited to the upper 5 feet of soil or to bedrock.
Source: National Cooperative Soil Survey.

Cover and Land Use

The four major cover and land uses, as defined in the glossary and explained in the introduction, have been summarized by acreage and ownership on tables 139 through 142. These broad categories have been determined both on the basis of cover and use. Cropland is more specifically a use category. Forest land has more than 10 percent forest cover. Rangeland areas have broad range cover characteristics. Other land includes land specifically based on use, such as urban, as well as that based specifically on cover characteristics such as rock and sand dune areas. The four major categories have been generalized for presentation on figure 28. Since this information has been generalized, isolated areas of different categories may occur within the broad patterns.

Cropland

Cropland in Subregion 6 includes much of the famous wheat producing region on loessal hills in the Palouse and Nez Perce Prairies and the Columbia Basin. Over one-fifth of the winter wheat produced annually in the United States comes from this area. On the loessal hills the major crops consist of soft winter wheat grown in rotation with peas or a legume/grass crop. The Palouse and Nez Perce Prairies are cropped annually and those of the Columbia Basin are cropped on alternate years with a year of summer fallow in between.

Table 139 - Cover and Land Use by Ownership, Subregion 6, 1966

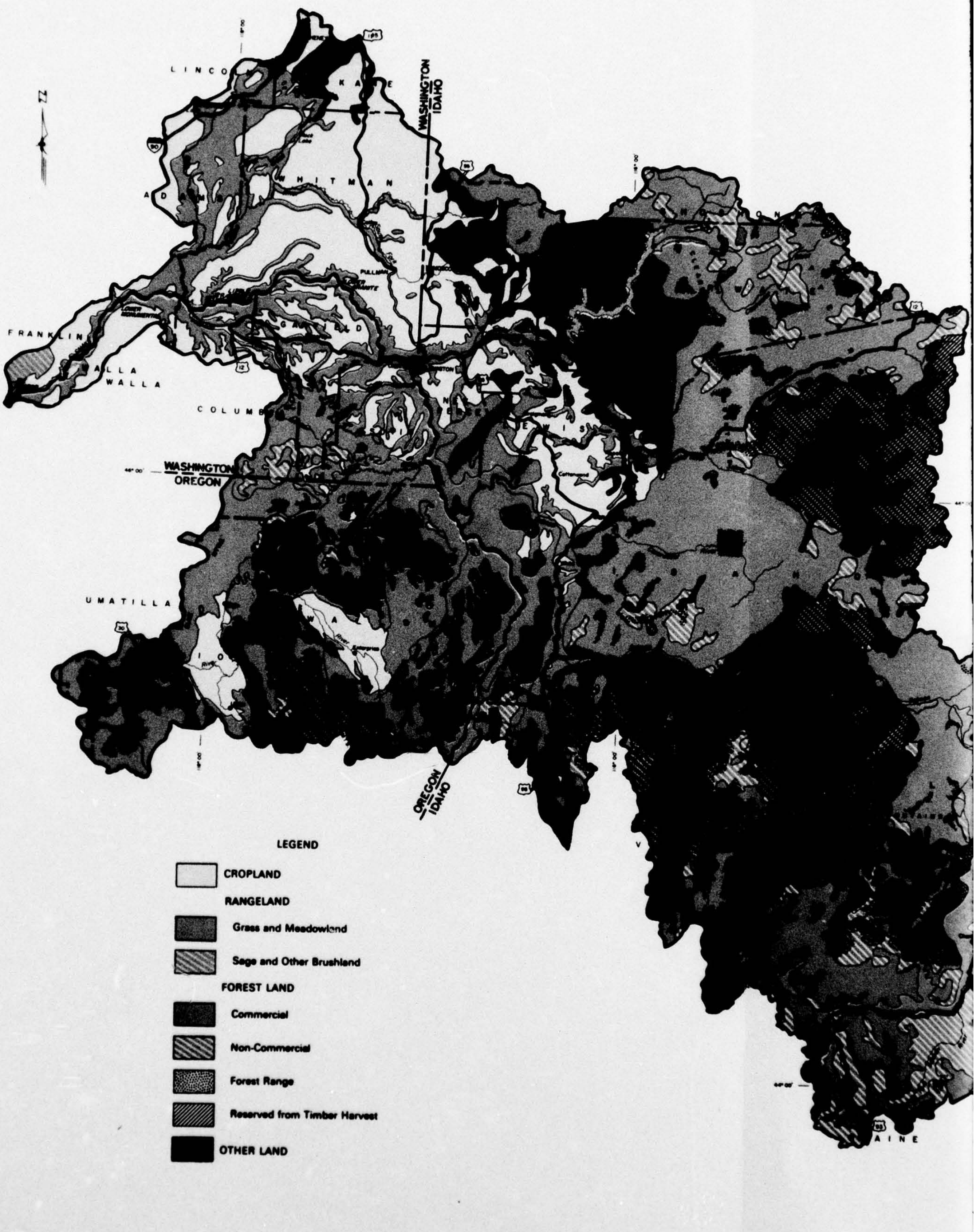
Ownership	Cropland	Forest Land	Rangeland	Other Land	Total
			(1,000 acres)		
Department of Agriculture					
Forest Service	-	11,017.6	1,110.4	212.5	12,340.5
Other Agriculture	.2	-	-	-	.2
	.2	11,017.6	1,110.4	212.5	12,340.7
Department of the Interior					
Bureau of Land Management	-	266.0	992.9	16.6	1,275.5
Bureau of Indian Affairs1/	40.2	24.4	25.0	-	89.6
National Park Service	-	-	-	-	-
Fish & Wildlife Service	.5	10.0	1.3	-	2.6
Bureau of Reclamation	1.3	-	4.0	-	14.5
Other Interior	-	-	-	-	-
	42.0	300.4	1,023.2	16.6	1,382.2
Department of Defense	-	7.0	41.9	32.2	81.1
Other Federal	-	-	-	-	-
Federal Subtotal	42.2	11,325.0	2,175.5	261.3	13,804.0
State	17.9	354.8	287.4	45.8	705.9
County	-	7.0	-	19.2	26.2
Municipal	-	-	-	8.8	8.8
Public Total	60.1	11,686.8	2,462.9	335.1	14,544.9
Private Total	3,017.7	1,850.3	2,578.9	379.4	7,826.3
Total Land Area	3,077.8	13,537.1	5,041.8	714.5	22,371.2

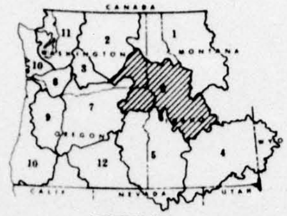
1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.

Table 140 Cover and Land Use by Ownership, State of Idaho, Subregion 6, 1966

Ownership	Cropland	Forest Land	Rangeland	Other Land	Total
			(1,000 acres)		
Department of Agriculture					
Forest Service	-	9,496.5	724.0	172.0	10,392.5
Other Agriculture	-	-	-	-	-
	-	9,496.5	724.0	172.0	10,392.5
Department of the Interior					
Bureau of Land Management	-	257.0	965.6	15.6	1,238.2
Bureau of Indian Affairs1/	40.2	24.4	25.0	-	89.6
National Park Service	-	-	-	-	-
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	1.3	-	1.3	-	2.6
Other Interior	-	-	-	-	-
	41.5	281.4	991.9	15.6	1,330.4
Department of Defense	-	7.0	.7	32.1	39.8
Other Federal	-	-	-	-	-
Federal Subtotal	41.5	9,784.9	1,716.6	219.7	11,762.7
State	.3	339.0	126.3	30.0	495.6
County	-	5.0	-	16.2	21.2
Municipal	-	-	-	3.8	3.8
Public Total	41.8	10,128.9	1,842.9	269.7	12,283.3
Private Total	1,030.5	1,175.1	960.7	244.7	3,411.0
Total Land Area	1,072.3	11,304.0	2,803.6	514.4	15,694.3

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.


LINCO
WHITMAN
ADAM
FRANKLIN
WALLA
WALLA
COLUMB
WASHINGTON
OREGON
WASHINGTON
IDAHO
UMATILLA
OREGON
IDAHO
AINE
LEGEND
CROPLAND
RANGELAND
Grass and Meadowland
Sage and Other Brushland
FOREST LAND
Commercial
Non-Commercial
Forest Range
Reserved from Timber Harvest
OTHER LAND



LOCATION MAP

COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

GENERALIZED COVER AND LAND USE

LOWER SNAKE, SUBREGION 6

1968

FIGURE 28

2

Table 141 - Cover and Land Use by Ownership, State of Oregon, Subregion 6, 1966

Ownership	Cropland	Forest Land	Rangeland	Other Land	Total
			(1,000 acres)		
Department of Agriculture					
Forest Service	-	1,294.1	343.5	40.5	1,678.1
Other Agriculture	-	-	-	-	-
	-	1,294.1	343.5	40.5	1,678.1
Department of the Interior					
Bureau of Land Management	-	8.0	14.0	-	22.0
Bureau of Indian Affairs1/	-	-	-	-	-
National Park Service	-	-	-	-	-
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	-	-	-	-	-
Other Interior	-	-	-	-	-
	-	8.0	14.0	-	22.0
Department of Defense	-	-	-	-	-
Other Federal	-	-	-	-	-
Federal Subtotal	-	1,302.1	357.5	40.5	1,700.1
State	1.6	7.0	9.1	8.7	26.4
County	-	2.0	-	.8	2.8
Municipal	-	-	-	2.9	2.9
Public Total	1.6	1,311.1	366.6	52.9	1,732.2
Private Total	295.3	538.4	574.8	27.5	1,436.0
Total Land Area	296.9	1,849.5	941.4	80.4	3,168.2

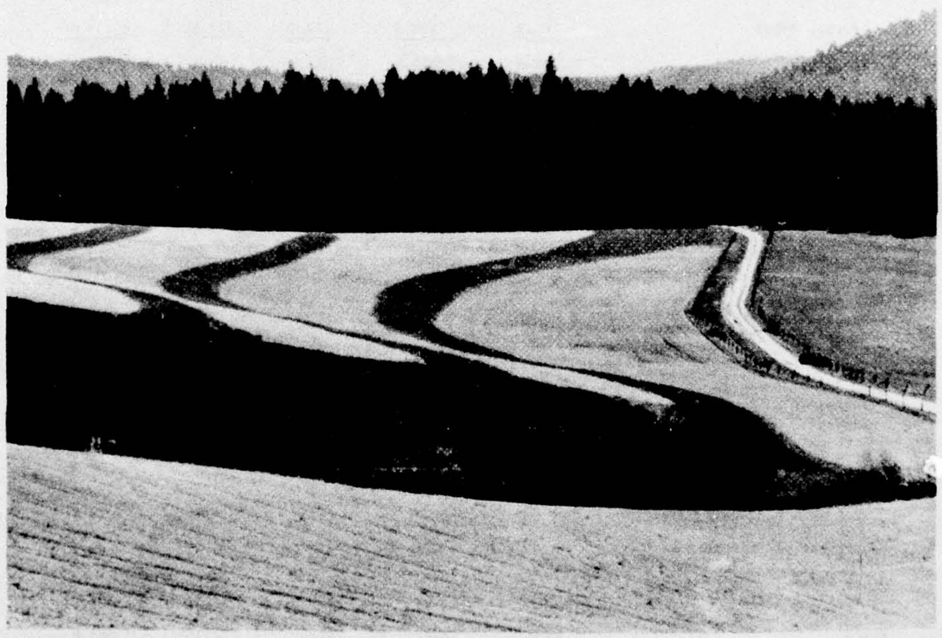
1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.

Table 142 - Cover and Land Use by Ownership, State of Washington, Subregion 6, 1966

Ownership	Cropland	Forest Land	Rangeland	Other Land	Total
			(1,000 acres)		
Department of Agriculture					
Forest Service	-	227.0	42.9	-	269.9
Other Agriculture	.2	-	-	-	.2
	.2	227.0	42.9	-	270.1
Department of the Interior					
Bureau of Land Management	-	1.0	13.3	1.0	15.3
Bureau of Indian Affairs1/	-	-	-	-	-
National Park Service	-	-	-	-	-
Fish & Wildlife Service	.5	10.0	4.0	-	14.5
Bureau of Reclamation	-	-	-	-	-
Other Interior	-	-	-	-	-
	.5	11.0	17.3	1.0	29.8
Department of Defense	-	-	41.2	.1	41.3
Other Federal	-	-	-	-	-
Federal Subtotal	.7	238.0	101.4	1.1	341.2
State	16.0	8.8	152.0	7.1	183.9
County	-	-	-	2.2	2.2
Municipal	-	-	-	2.1	2.1
Public Total	16.7	246.8	253.4	12.5	529.4
Private Total	1,691.9	136.8	1,043.4	107.2	3,079.3
Total Land Area	1,708.6	383.6	1,296.8	119.7	3,508.7

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.

Another major cropland area consists of high bottomlands in northwest Oregon and in Idaho. This area includes some low terraces, fans, and footslopes. It occurs generally at elevations above 3,500 feet and is devoted to hay and pasture crops with an occasional crop of grain or irrigated potatoes. The other contrasting cropland area is on the flood plains adjacent to major rivers. Elevations are generally less than 2,000 feet above sea level. These flood plains are irrigated and grow tree fruits, cane fruits, and many of the truck crops. This cropland area is restricted in size and occurrence. Table 143 shows the cropland acreage and extent by representative categories of crops and figure 28 shows cover and land use that locates the cropland area.



Grain-forage cropland use of soils formed in wind deposited silt of the hilly Palouse formation. Strip cropping designed to control erosion under annual precipitation of more than 20 inches. Many fringe areas of forest land have high potential for cropland use. (S.C.S. Ida 162)

Table 143 - Cropland Acreage of Representative Categories of Crops by States, Subregion 6, 1966

Categories of Crops	Idaho	Oregon	Washington (1,000 acres)	Total	Percent
Dryland Cropland1/					
Forage crops	135.0	41.6	16.1	192.7	6.3
Close grown field crops	793.7	151.2	1,642.8	2,587.7	84.1
Specialty crops3/	4.4	6.2	19.0	29.6	1.0
Total dryland crops	933.1	199.0	1,677.9	2,810.0	91.4
Irrigated Cropland1/					
Forage crops	128.5	54.3	21.3	204.1	6.6
Close grown field crops	7.8	37.6	3.9	49.3	1.6
Row crops2/	2.6	-	4.9	7.5	.2
Specialty crops3/	.3	6.0	.6	6.9	.2
Total irrigated crops	139.2	97.9	30.7	267.8	8.6
Total cropland	1,072.3	296.9	1,708.6	3,077.8	100.0

1/ Does not include other land that is irrigated (table 152).
2/ Includes sugar beets, potatoes, beans, corn, etc.
3/ Includes mint, vegetable seed, and other special and inextensive crops.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Forest Land

Forests cover 13,537,100 acres or 61 percent of the total land area in Subregion 6. Within its boundaries, 72 percent of Idaho, 58 percent of Oregon, and 11 percent of Washington are forested. This forest cover dominates the mountainous areas, including all but the Snake River Valley, its lower tributaries, and the drier portions of the Salmon River.

Nearly 12 million acres of the forest land are publicly owned. Of this, 95 percent is national forest, 2 percent is Public Domain, and 3 percent is state owned. The balance, almost 2 million acres, is privately owned. (Tables 144 through 147)

Timber Over 10 million acres of the forest area are classed as commercial forest land. Douglas-fir and the true fir-spruce type predominate, with ponderosa and lodgepole pine a close second. Other major types include the larch and white pine. The remaining 3.25 million acres are noncommercial forest, about three-quarters on lands reserved from timber harvesting and one-quarter on nonproductive areas found near timberline and along the desert fringes.

Seventy percent of the commercial forest land is in the sawtimber class. Some 16 percent is classed as pole timber, and 8 percent sapling and seedlings. Six percent is nonstocked. Nearly 1.7 million acres of the commercial forest land have been withdrawn from cutting in classified and other designated areas. The balance supports nearly 75 billion board feet of commercial timber, supplying raw material for a forest products industry which furnishes 81 percent of the subregion's manufacturing employment.

Table 145 - Forest Land Acreage by Generalized Type and Ownership, State of Idaho, Subregion 6, 1966

Ownership	Commercial Forest Land	Non-Commercial Forest Land: Productive Reserved	Non-Commercial Forest Land: Unproductive Reserved	Non-Commercial Forest Land: Unproductive	Total
	(1,000 acres)				
Forest Service	6,609.0	1,612.0	569.0	706.5	9,496.5
Bureau of Land Management	196.0	-	-	61.0	257.0
Bureau of Indian Affairs 1/	20.0	-	-	4.4	24.4
National Park Service	-	-	-	-	-
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	-	-	-	-	-
Department of Defense	7.0	-	-	-	7.0
Other Federal	-	-	-	-	-
Federal Subtotal	6,832.0	1,612.0	569.0	771.9	9,784.9
State	334.0	-	-	5.0	339.0
County	5.0	-	-	-	5.0
Municipal	-	-	-	-	-
Public Total	7,171.0	1,612.0	569.0	776.9	10,128.9
Private Total	1,149.0	-	-	26.1	1,175.1
Grand Total	8,320.0	1,612.0	569.0	803.0	11,304.0

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Intermountain Experiment Station.

Table 144 - Forest Land Acreage by Generalized Type and Ownership, Subregion 6, 1966

Ownership	Commercial Forest Land	Non-Commercial Forest Land: Productive Reserved	Non-Commercial Forest Land: Unproductive Reserved	Non-Commercial Forest Land: Unproductive	Total
	(1,000 acres)				
Forest Service	7,847.8	1,691.0	670.3	808.5	11,017.6
Bureau of Land Management	204.0	-	-	62.0	266.0
Bureau of Indian Affairs 1/	20.0	-	-	4.4	24.4
National Park Service	-	-	-	-	-
Fish & Wildlife Service	10.0	-	-	-	10.0
Bureau of Reclamation	-	-	-	-	-
Department of Defense	7.0	-	-	-	7.0
Other Federal	-	-	-	-	-
Federal Subtotal	8,088.8	1,691.0	670.3	874.9	11,325.0
State	348.8	1.0	-	5.0	354.8
County	7.0	-	-	-	7.0
Municipal	-	-	-	-	-
Public Total	8,444.6	1,692.0	670.3	879.9	11,686.8
Private Total	1,812.2	-	-	38.1	1,850.3
Grand Total	10,256.8	1,692.0	670.3	918.0	13,537.1

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest and Intermountain Experiment Stations.

Table 146 - Forest Land Acreage by Generalized Type and Ownership, State of Oregon, Subregion 6, 1966

Ownership	Commercial Forest Land	Non-Commercial Forest Land: Productive Reserved	Unproductive Reserved	Unproductive	Total
	(1,000 acres)				
Forest Service	1,050.8	79.0	101.3	63.0	1,294.1
Bureau of Land Management	7.0	-	-	1.0	8.0
Bureau of Indian Affairs 1/	-	-	-	-	-
National Park Service	-	-	-	-	-
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	-	-	-	-	-
Department of Defense	-	-	-	-	-
Other Federal	-	-	-	-	-
Federal Subtotal	1,057.8	79.0	101.3	64.0	1,302.1
State	6.0	1.0	-	-	7.0
County	2.0	-	-	-	2.0
Municipal	-	-	-	-	-
Public Total	1,065.8	80.0	101.3	64.0	1,311.1
Private Total	529.4	-	-	9.0	538.4
Grand Total	1,595.2	80.0	101.3	73.0	1,849.5

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest Experiment Station.

Table 147 - Forest Land Acreage by Generalized Type and Ownership, State of Washington, Subregion 6, 1966

Ownership	Commercial Forest Land	Non-Commercial Forest Land: Productive Reserved	Unproductive Reserved	Unproductive	Total
	(1,000 acres)				
Forest Service	188.0	-	-	39.0	227.0
Bureau of Land Management	1.0	-	-	-	1.0
Bureau of Indian Affairs 1/	-	-	-	-	-
National Park Service	-	-	-	-	-
Fish & Wildlife Service	10.0	-	-	-	10.0
Bureau of Reclamation	-	-	-	-	-
Department of Defense	-	-	-	-	-
Other Federal	-	-	-	-	-
Federal Subtotal	199.0	-	-	39.0	238.0
State	8.8	-	-	-	8.8
County	-	-	-	-	-
Municipal	-	-	-	-	-
Public Total	207.8	-	-	39.0	246.8
Private Total	133.8	-	-	3.0	136.8
Grand Total	341.6	-	-	42.0	383.6

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest Experiment Station.

Forest Range Included in the forest range are 4.6 million acres classified as commercial forest and 119,000 acres classified as noncommercial forest. This 4.7 million acres of forest range represent 35 percent of the total forest land. The commercial forest range is predominantly in the southern part of the subregion with a lesser acreage in northeastern Oregon.

It is estimated that 30 percent of the forest range is in good condition, 50 percent is in fair condition, and 20 percent is in poor condition. Carrying capacity varies from 2 acres per AUM to in excess of 40 acres per AUM. The approximate carrying capacity for the forest range is 312,000 AUMs, with the private sector accounting for 35 percent and the public range accounting for 65 percent.

The Forest Service administers 55 percent or 2.6 million acres of the forest range in this subregion. The privately owned forest range accounts for another 35 percent of 1.6 million acres. The remaining 10 percent is owned by state or county government or administered by other Federal agencies.

Forest range is characterized by moderate slopes with elevations ranging from 1,000 to 8,500 feet. Forage species consist mainly of sagebrush, antelope bitterbrush, and mountain mahogany. Various other brush species such as ceanothus, chokecherry, elderberries, and serviceberry are also found. Grass understory is predominantly bluebunch wheatgrass. Also found are pinegrass, Idaho fescue, Sandberg bluegrass, and cheatgrass. Sedge and various meadow species are found in the open wetter sites.

Other Uses Forest lands provide 82 percent of the subregion's runoff. The value of the quantity and quality of this water is reflected in the estimated 63,000 people, or 84 percent of the urban population, dependent on surface water flows for domestic use.

The forest lands furnish an important part of the subregion's outdoor recreation area. Hunting, fishing, and other outdoor activities center in and around these wooded lands. Public forest land furnished areas and facilities for over 3 million recreation visits in 1965. These included use at developed campgrounds, winter sports areas, and in the general outdoor environment. The private forest land furnishes a much less, but still significant, part of the recreation resource and includes several developed campgrounds.

These same acres provide habitat for a major portion of the big game found in the subregion. Deer, elk, bear, and a variety of smaller game utilize these forests. About 500,000 hunter visits were counted in 1965 on the forest land of the subregion.

Rangeland

In Subregion 6 some 5.0 million acres are rangelands, accounting for 23 percent of the total land area. This subregion accounts for 9 percent of all rangeland in the region. Tables 148 through 151 show the different categories of rangeland by ownership.

A third of the rangeland is concentrated in the southeastern part of the subregion in the upper Salmon River area and the Lemhi Valley. The other two-thirds is concentrated in the western part along the Snake River and tributary valleys in Oregon, Washington, and Idaho.

Table 148 - Rangeland and Forest Range Acreage by Range Type and Ownership, Subregion 6, 1966

Category	Federal					Non-Federal		Grand Total
	BLM	FS	BIA	Other	Total	State & County	Private	
				(1,000 acres)				
Rangeland								
Grasslands	162.2	702.7	25.0	17.3	907.7	206.0	2,188.2	3,301.4
Sagebrush	826.0	361.6	-	24.8	1,212.4	67.6	216.8	1,496.8
Brushland other than sage	4.7	46.1	-	5.1	55.9	13.8	173.9	243.6
Total	992.9	1,110.4	25.0	47.2	2,175.5	287.4	2,578.9	5,041.8
Forest Range 1/								
Commercial Forest	110.5	2,484.9	20.0	7.2	2,622.6	334.7	1,609.9	4,567.2
Noncommercial Forest								
Sub-alpine	13.6	42.9	-	-	56.5	2.2	8.5	67.2
Desert Fringe	1.0	38.1	-	-	39.1	2.8	9.6	51.5
Total (noncommercial)	14.6	81.0	-	-	95.6	5.0	18.1	118.7
Total (forest range)	125.1	2,565.9	20.0	7.2	2,718.2	339.7	1,628.0	4,685.9
Grand Total	1,118.0	3,676.3	45.0	54.4	4,893.7	627.1	4,206.9	9,727.7

1/ Forest and woodland grazed or potentially usable for forage production. Forest range acreage is included within the total forest statistics shown on table 144.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Table 149 - Rangeland and Forest Range Acreage by Range Type and Ownership, State of Idaho, Subregion 6, 1966

Category	Federal					Non-Federal		Grand Total
	BLM	FS	BIA	Other	Total	State & County	Private	
				(1,000 acres)				
Rangeland								
Grasslands	146.8	321.3	25.0	.6	493.7	104.7	785.3	1,383.7
Sagebrush	817.6	361.6	-	1.4	1,180.6	12.6	96.1	1,289.3
Brushland other than sage	1.2	41.1	-	-	42.3	9.0	79.3	130.6
Total	965.6	724.0	25.0	2.0	1,716.6	126.3	960.7	2,803.6
Forest Range 1/								
Commercial Forest	103.0	2,091.2	20.0	-	2,214.2	330.1	1,009.0	3,553.3
Noncommercial Forest								
Sub-alpine	13.6	20.0	-	-	33.6	2.2	8.5	44.3
Desert Fringe	-	38.1	-	-	38.1	2.8	9.6	50.5
Total (noncommercial)	13.6	58.1	-	-	71.7	5.0	18.1	94.8
Total (forest range)	116.6	2,149.3	20.0	-	2,285.9	335.1	1,027.1	3,648.1
Grand Total	1,082.2	2,873.3	45.0	2.0	4,002.5	461.4	1,987.8	6,451.7

1/ Forest and woodland grazed or potentially usable for forage production. Forest range acreage is included within the total forest statistics shown in table 144.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Table 150 - Rangeland and Forest Range Acreage by Range Type and Ownership, State of Oregon, Subregion 6, 1966

Category	Federal					Non-Federal		
	BLM	FS	BIA	Other	Total	State & County	Private	Grand Total
	(1,000 acres)							
Rangeland								
Grasslands	10.0	338.5	-	-	348.5	9.1	560.2	917.8
Sagebrush	4.0	-	-	-	4.0	-	6.4	10.4
Brushland other than sage	-	5.0	-	-	5.0	-	8.2	13.2
Total	14.0	343.5	-	-	357.5	9.1	574.8	941.4
Forest Range 1/								
Commercial Forest	7.0	376.5	-	-	383.5	4.0	500.0	887.5
Noncommercial Forest								
Sub-alpine	-	22.9	-	-	22.9	-	-	22.9
Desert Fringe	1.0	-	-	-	1.0	-	-	1.0
Total (noncommercial)	1.0	22.9	-	-	23.9	-	-	23.9
Total (forest range)	8.0	399.4	-	-	407.4	4.0	500.0	911.4
Grand Total	22.0	742.9	-	-	764.9	13.1	1,074.8	1,852.8

1/ Forest and woodland grazed or potentially usable for forage production. Forest range acreage is included within the total forest statistics shown in table 144.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Table 151 - Rangeland and Forest Range Acreage by Range Type and Ownership, State of Washington, Subregion 6, 1966

Category	Federal					Non-Federal		
	BLM	FS	BIA	Other	Total	State & County	Private	Grand Total
	(1,000 acres)							
Rangeland								
Grasslands	5.4	42.9	-	16.7	65.0	92.2	842.7	999.9
Sagebrush	4.4	-	-	23.4	27.8	55.0	114.3	197.1
Brushland other than sage	3.5	-	-	5.1	8.6	4.8	86.4	99.8
Total	13.3	42.9	-	45.2	101.4	152.0	1,043.4	1,296.8
Forest Range 1/								
Commercial Forest	.5	17.2	-	7.2	24.9	.6	100.9	126.4
Noncommercial Forest								
Sub-alpine	-	-	-	-	-	-	-	-
Desert Fringe	-	-	-	-	-	-	-	-
Total (noncommercial)	-	-	-	-	-	-	-	-
Total (forest range)	.5	17.2	-	7.2	24.9	.6	100.9	126.4
Grand Total	13.8	60.1	-	52.4	126.3	152.6	1,144.3	1,423.2

1/ Forest and woodland grazed or potentially usable for forage production. Forest range acreage is included within the total forest statistics shown in table 144.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

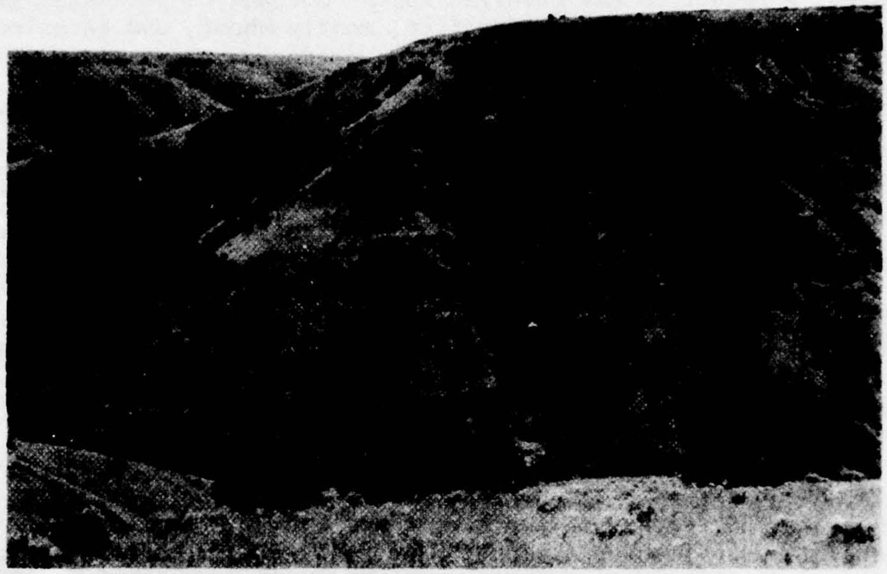
It is estimated that 1.2 million acres or 25 percent of all the rangeland is in good range condition, 2.1 million acres or 41 percent is in fair condition, and 1.7 million or 34 percent is in poor condition. The estimated carrying capacity is 820,000 AUMs, with the private range sector accounting for 52 percent and the public range 48 percent.

Nearly 2.6 million acres of rangeland are in private ownership, which represents 51 percent of the total. Another 2.2 million acres are under Federal jurisdiction primarily managed by the Forest Service and the Bureau of Land Management. The remaining 287,000 acres are owned by state or county governments.

Open grasslands and meadows containing grass and forb types cover 3.3 million acres and account for 65 percent of the rangeland. About 28 percent is in good condition, 40 percent in fair condition, and 32 percent in poor condition. Since settlement has expanded in the area, a reduction has occurred in the acreage of perennial grass and forb types, caused by cultivation, mostly wheat, and invasion by sagebrush. Bluebunch wheatgrass is the predominant grass species and some of the most productive areas in the region are found in the Palouse area of Washington. Other common native grasses are Idaho fescue, Indian ricegrass, western wheat, bluegrasses, and cheatgrass. Native grasses are located in the 10-inch to 20-inch rainfall areas. The annual grass and forb types are confined to those areas which have been depleted and were formerly either sagebrush or perennial grass and forb areas. Widespread plowing, improper grazing management, and fire have contributed to this changeover. The meadow type which lies either within the forest types or in moist drainage bottoms occupies a relatively small acreage of this broad category. In large part, meadows are still extensively used by domestic livestock.

Sagebrush, including all nontimbered land where sagebrush or similar shrubby species predominate, covers 1.5 million acres and accounts for 30 percent of the rangeland. It is estimated that 18 percent is in good condition, 46 percent in fair condition, and 36 percent in poor condition. The sagebrush type has the greatest potential for improvement. Seedings and brush control sprayings can increase the grass cover for soil stabilization from two to 10 times, particularly on those ranges in fair and poor condition. The sagebrush type predominates in the plains and foothills in the southeastern part of the subregion, occupying level to rather steep terrain on all expanses to an elevation of about 6,000 feet. Precipitation in this zone ranges from 10 to 20 inches, with the greater proportion coming as snow or winter rain. Protracted drouths during the summer are common.

Brushland other than sage characteristically occupies the transition zone of lower mountain slopes, foothills, and plateau areas. This third category of rangeland covers some 244,000 acres and accounts for 5 percent of the rangeland. This range condition is similar to that of the sagebrush range. Annual precipitation normally ranges from 20 to 30 inches with the greater part occurring during the winter months as snow. This type is found in small scattered areas and strips throughout the subregion, generally between the coniferous forest and the grassland and sagebrush types. Although small, brushland is usually more important for wildlife use, particularly deer, than any other type.



Basalt rock land on canyon side slopes; generally over 50 percent barren. Area has limited grazing use. (S.C.S. F-245-12)

Other Land

The other land use in Subregion 6 consists of 714,500 acres or over 3 percent of the land area. This includes barren land and rock in alpine areas that make up almost 80 percent of the other land total. About 16 percent of the total is urban, industrial areas, farmsteads, roads, and other miscellaneous use areas. Four percent consists of water areas less than 40 acres in size and streams less than one-eighth mile wide. Table 152 shows the other land acreage by the states and extent.

Table 152 - Other Land, Subregion 6, 1966

Kinds of Land Use	Oregon	Washington	Idaho	Total	Percent
		(1,000 acres)			
Barren	50.2	46.6	471.1	567.9	79.5
Roads and Railroads	10.3	41.1	17.7	69.1	9.7
Small water 1/	8.7	9.3	10.6	28.6	4.0
Miscellaneous 2/	11.2	22.7	15.0	48.9	6.8
Total other land	80.4	119.7	514.4	714.5	100.0

1/ Water areas less than 40 acres in size and streams less than one-eighth mile in width.

2/ Includes urban and industrial areas, farmsteads, airports, and other areas.

Source: Compiled by the Soil Conservation Service Columbia-North Pacific River Basin Staff.

MINERAL RESOURCES

About one-third or more of Subregion 6 is underlain by the Idaho batholith; a great mass of intrusive granitic type rocks of late Mesozoic and early Tertiary age. This batholith, with its marginal zone of altered rocks in Idaho, includes Clearwater, Idaho, and Valley counties, and the western parts of Lemhi and Custer counties. On the east in Lemhi and Custer counties, the batholith is flanked by the Challis Volcanics of Tertiary age and sedimentary rocks of Precambrian and Paleozoic age. On the west, a small area in western Idaho and Valley counties is underlain by volcanic and sedimentary rocks of Triassic or Permian age; they are exposed in the Snake River Canyon just below the mouth of the Imnaha. The north end of the subregion is underlain by a granitic intrusion similar to the batholith, and by metasediments of Precambrian age exposed in Latah County and adjacent Whitman County, Washington. The western part of the subregion in Washington and Oregon and western Latah Nez Perce, and Lewis counties, Idaho, is largely underlain by Columbia River basalt flows of middle Tertiary age except for a small mass of granitic rocks that project through the basalt in Union and Wallowa counties, south of Enterprise.

The Idaho batholith and its marginal zone, together with the Challis volcanics and metasediments in Lemhi and Custer counties in Idaho and the smaller granitic area south of Enterprise, contain a wide variety of metallic mineral deposits, some of which have a record of substantial past production and many of which have potential for future development and production. In contrast, the part of the subregion underlain by basalt in Washington, Oregon, and the western border of Idaho contains few metalliferous deposits; production has been limited mostly to clay, stone, gravel, and a few other nonmetallic minerals.

The subregion has produced substantial amounts of gold, silver, copper, lead, and zinc, and, in addition, for several years accounted for almost the entire domestic production of antimony, cobalt, columbium, and tantalum. During the critical World War II years, it provided nearly 40 percent of the domestic production of tungsten and was a large supplier of mercury. Mining is currently at a much reduced rate but the subregion has a high potential for future mineral production. Approximate location of mineral deposits are shown on the mineral resources map, figure 29, and table 153.

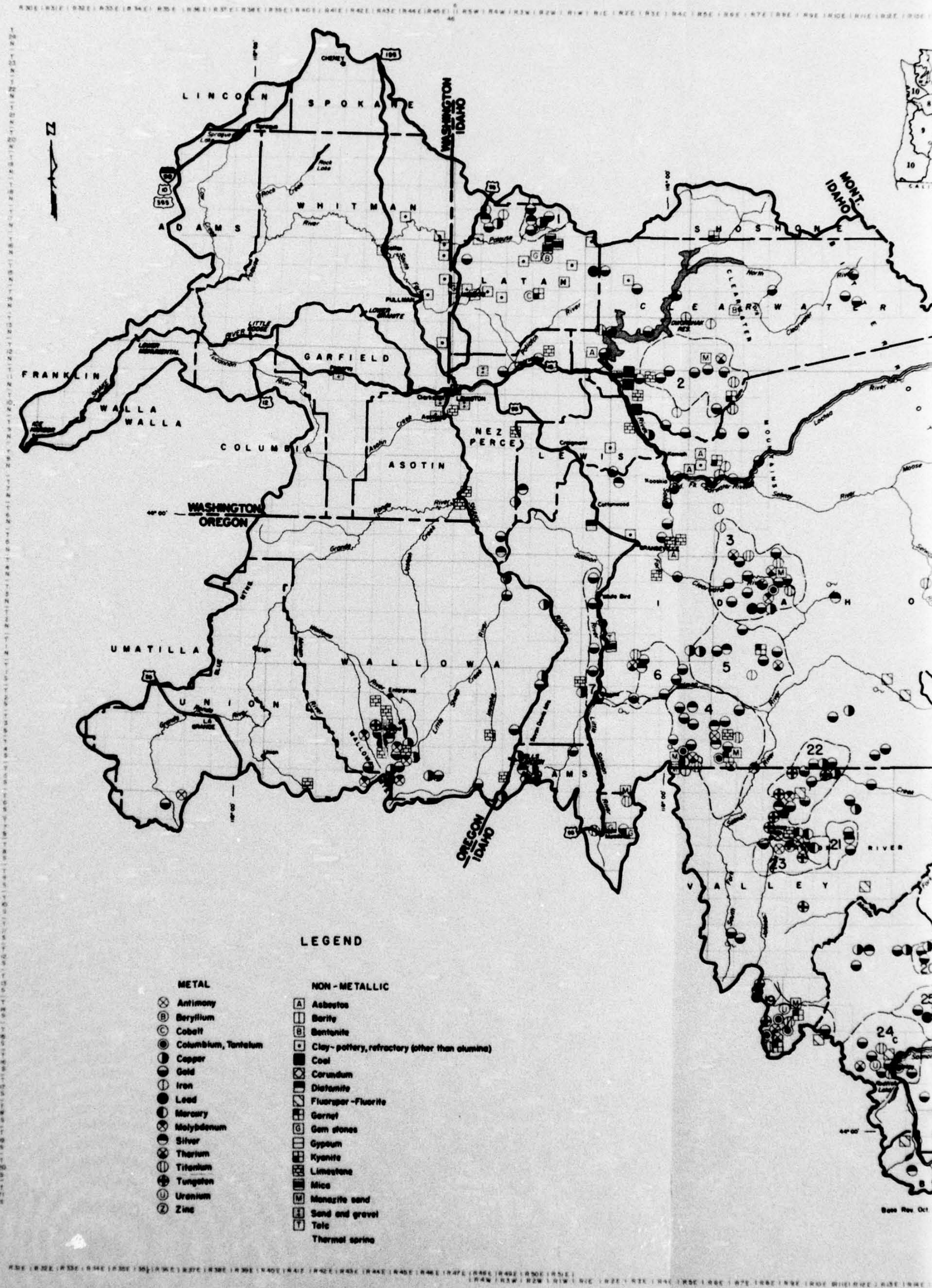
Metals

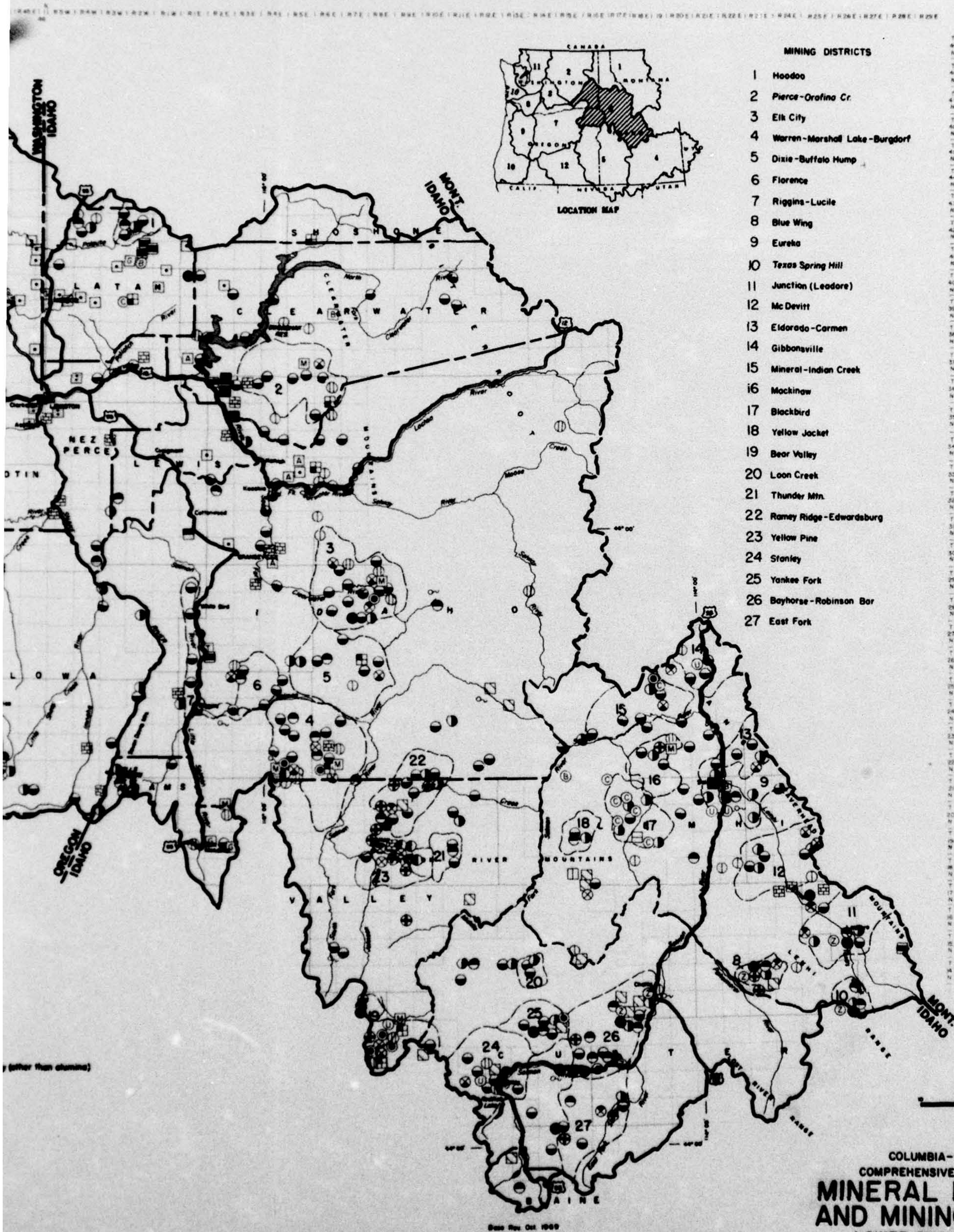
Gold deposits are the most widespread in Subregion 6 and accounted for most of the early day metal output. Placer gold deposits were the first discovered and the first to be worked because of their accessibility and the relatively simple recovery methods required. Somewhat later the lode deposits were found and developed. Many deposits, developed originally for gold, were found to contain other minerals that sometimes proved to be of more value than the gold content. Some mining districts produced mainly lead and zinc, copper and gold, copper and cobalt, or silver and lead.

Many of the mining districts, where placer gold deposits were formerly very productive, have long been depleted or exhausted and some are almost forgotten; other districts are presently inactive but are known to contain mineral reserves or are believed to have some undeveloped reserves; and finally, several districts are currently active on a reduced scale from that of the period of their greatest productivity, but under changing conditions may again be major producers. The principal mining districts are shown in figure 29 and described in table 153.

The Clearwater River drainage contains several districts formerly noted for gold produced from rich placers and some lode deposits. The Pierce-Orofino Creek District is credited with the first discovery of gold in Idaho in 1860. It was very productive for the period 1860-1870. Total production was about 385,000 ounces.

Near the headwaters of the South Fork of the Clearwater, the Elk City District has produced a large amount of gold mostly from placer depsoits on Tenmile and Newsome Creeks, Elk, American, Crooked, and Red Rivers, all tributaries of the South Fork. A few lode deposits were developed near Orogrande that produced gold, more than 100,000 ounces of silver, and a small amount of lead and copper. An output of 550,000 to 800,000 ounces of gold has come mostly from the placers in this district, the richest of which were exhausted by 1872; there remain some lower grade placer and lode deposits. Some placer mining activity continues to the present time. There are occurrences of gold, silver, lead, iron, copper,


LINCOLN
SPOKANE
WASHINGTON
IDAHO
WHITMAN
ADAMS
LATAH
FRANKLIN
WALLA WALLA
GARFIELD
COLUMBIA
ASOTIN
NEZ PERCE
LEWIS
CLEARWATER
SHOSHONE
MONT.
IDAHO
WASHINGTON
OREGON
UMATILLA
UNION
WALLOWA
OREGON
IDAHO
VALLEY
RIVER
LEGEND
METAL
Antimony
Beryllium
Cobalt
Columbium, Tantalum
Copper
Gold
Iron
Lead
Mercury
Molybdenum
Silver
Thorium
Titanium
Tungsten
Uranium
Zinc
NON-METALLIC
Asbestos
Barite
Bentonite
Clay-pottery, refractory (other than alumina)
Coal
Corundum
Diatomite
Fluorspar-Fluorite
Garnet
Gem stones
Gypsum
Kyanite
Limestone
Mica
Monazite sand
Sand and gravel
Talc
Thermal spring



COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

MINERAL RESOURCES AND MINING DISTRICTS

LOWER SNAKE, SUBREGION 6

2

FIGURE 29

Table 153 - Mining Districts, Subregion 6

Index No.				Size of Districts - Production Plus Potential Reserves 1/					
Fig.	District	County	Drainage	Gold	Silver	Copper	Lead	Zinc	References
1	Hoodoo	Latah	Placer & lode deposits on North Fork, Palouse River, Mizpah Creek and Hoodoo Gulch.	2 1/	3 1/	3 1/	-	-	Hubbard, C.R., Idaho Bur. Mines & Geol.County Rept. 2, 1957
2	Pierce-Orofino Creek	Clearwater	Placers & lode deposits on Orofino Creek tributary to Clearwater River	1	-	-	-	-	Thomson, F. A., & Ballard, Idaho BurMines & Geol.Bull. 7, 1924
3	Elk City	Idaho	Placer & lode deposits on Tenmile & Newsome Creeks, Elk, American, Crooked, and Red Rivers, tributaries to South Fork of Clearwater River	1	2	-	-	-	Reid, R. R., Idaho Bur. Mines & Geol. Pamph. 121, 1960
4	Warren-Marshall Lake-Burgdorf	Idaho	Placer & lode deposits near head of Warren & California Creeks, tributaries to the Salmon River	1	2	-	-	-	Reed, J.C., Idaho Bur. Mines & Geol. Pamph. 45, 1937
5	Dixie-Buffalo Hump	Idaho	Placer & lode deposits near head of Crooked Creek, tributary to Salmon River	1	-	-	-	-	Thomson and Ballard, 1924
6	Florence	do	Placers on French Creek and near head of Slate Creek, tributary to Salmon	1					Lorain, S. H., & Melzger, V.S. Bu.Min.Inf.Circ 7023, 1938
7	Riggins-Lucile	do	Placer on main stem Salmon River from Riggens to Whitebird	2					Lorain and Melzger 1938
8	Blue Wing	Lemhi	Lode deposits near Patterson Creek, tributary to the Pahsimeroi River	-	2	3	2 1/	2 1/	Callaghan, E., & Lemmon, 1941, US Geol. Survey Bull. 931-A.
9	Eureka	Lemhi	Lode deposits near main stem Salmon River in vicinity of Salmon, Idaho	3	2	3	-	-	Anderson, A.L., 1956, Idaho Bur. Mines & Geol. Pamph. 106
10	Texas-Spring Hill	do	Lode deposits near headwater of Texas Creek, tributary to Lemhi River	2	1	3	1	2	Umpleby, J.B., 1913, U.S.Geol. Survey Bull. 528.
11	Junction (Leadore)	do	Lode deposits near Timber Canyon and Eightmile Creeks tributaries to Lemhi River	3	2	3	2	2	Umpleby, J.B., 1913
12	McDevitt	do	Lode deposits on McDevitt and Agency Creeks tributaries to Lemhi River	3	-	3	-	-	do
13	Eldorado-Carmen	do	Placer & lode deposits on Eldorado and Carmen Creeks, tributary to Salmon River	2	-	3	-	-	do
14	Gibbonsville	do	Placer & lode deposits near head of North Fork Salmon River	1	-	-	-	-	do

Table 153 - continued

15	Mineral-Indian Creek	do	Lode & placer deposits on Indian and Boulder Creeks, tributaries to Salmon River	2	-	3	-	-	Lorain & Metzger, 1939
16	Mackinaw	do	Placer & lode deposits near head of Moose, Beaver, & Napias Creeks, tributary to the Salmon River	1	-	-	-	-	Shockey, P.N., 1957, Idaho Bur. Mines & Geol. Pamph. 113
17	Blackbird	do	Lode deposits near head of Panther Creek, tributary to Salmon River, leading copper-cobalt-gold producer in Subregion in period 1950-60.	2	-	1	-	-	Vhay, J.S., 1948 U.S.Geol.Survey Prel.Rept. 3-219.
18	Yellow Jacket	Lemhi	Lode deposits near head of Yellow Jacket Creek, tributary to Camas Creek, tributary to Middle Fork, Salmon	2	-	-	-	-	Anderson,A.L. 1953, Idaho Bur. Mines & Geol. Pamph. 94
19	Bear Valley	Valley	Placer and lode deposits on Bear Valley Creek at head of Middle Fork, Salmon River. Largest producer of tantalum, columbium, uranium & rare earths in Subregion production period 1955-59.	1	-	-	-	-	Kline, M.H., Carlson, Storch, & Robertson, 1953. U.S.Atomic Energy Comm.Tech.Info. RME-3130
20	Loon Creek	Custer	Placer & lode deposits along Loon Creek, tributary to Warm Springs Creek, tributary to Middle Fork Salmon	2	-	3	-	-	Ross, C.P., 1934, U.S.Geol.Survey Bull. 854.
21	Thunder Mtn.	Valley	Lode deposits at head of Monumental Creek, tributary to Big Creek, tributary to Middle Fork of Salmon River	2	3	-	-	-	Shenon, P.J., and Ross, 1936 Idaho Bur. Mines & Geol. Pamp. 44.
22	Ramey Ridge-Edwardsburg	Idaho	Lode & placer deposits near the head of Big Creek, tributary to the Middle Fork Salmon	2	-	3	-	-	Shenon & Ross, 1963.
23	Yellow Pine	Valley	Lode deposits on the South Fork Salmon River. Also large production of antimony, tungsten, and mercury	1	2	-	-	-	Cooper, J.R., 1951, U.S.Geol.Survey Bull. 969-F
24	Stanley	Custer	Lode & placer deposits near Valley Creek, tributary to upper Salmon River. Also uranium production.	3	-	-	-	-	Choate, R., 1962, Idaho Bur.Mines & Geol. Pamph. 126
25	Yankee Fork	do	Placer & lode deposits on the Yankee Fork, tributary to upper Salmon River.	1	1	-	3	-	Anderson,A.L., 1949, Idaho Bur.Mines & Geol.Pamph. 83
26	Bayhorse-Robinson Bar	do	Lode & placer deposits along main stem of Salmon River from Warm Springs Creek to Challis Creek. Also tungsten production.	3	1	3	1	1	Ross, C.P., 1937, U.S.Geol.Survey Bull. 877.
27	East Fork	do	Lode deposits on upper East Fork tributary to upper Salmon River	3	2	-	-	-	Umpleby, J.B., 1913.

1/ Size

Index	Gold (Troy Ounces)	Silver (Troy Ounces)	Copper (Net Tons)	Lead (Net Tons)	Zinc (Net Tons)
1	100,000-1,000,000	5,000,000-50,000,000	100,000-1,000,000	100,000-1,000,000	100,000-1,000,000
2	10,000- 100,000	100,000- 5,000,000	10,000- 100,000	10,000- 100,000	10,000- 100,000
3	1,000- 10,000	1,000- 100,000	1,000- 10,000	1,000- 10,000	1,000- 10,000

zinc, and other metals in the Clearwater drainage that have been little explored to date. Access is difficult in most of the area.

The Salmon River drainage contains many of the best known mining districts in Idaho. On the lower Salmon below the mouth of the South Fork, placer gold has been recovered from bars and terraces along the river and on many of its tributaries from Warren Creek downstream to near White Bird. The more productive districts were the Warren-Marshall Lake-Burgdorf districts near the head of Warren, Lake, and California creeks, where more than 900,000 ounces of gold came mostly from placer deposits. Some gold and more than 100,000 ounces of silver were produced from lode deposits in each district. The Burgdorf District produced a small amount of monazite sands from Ruby Meadows. The Dixie and Buffalo Hump districts near the head of Crooked Creek produced 60,000 to 100,000 ounces of gold from both placer and lode deposits.

The Florence District, credited with about 1 million ounces of gold from placers, was the most productive district in the more than 100,000 ounces of silver with a small output of gold. The Riggins-Lucile District has produced about 38,000 ounces from placers. A small amount of mining activity continues sporadically in these districts, and a small future gold production may be anticipated, particularly during periods when economic conditions favor gold mining. In addition to gold and silver, the lower Salmon River region contains known occurrences of copper, lead, zinc, titanium, thorium, and other metals that have had little or no development and production to date.

The middle part of the Salmon River and its tributaries, from the mouth of the Pahsimeroi River downstream to the South Fork of the Salmon, is also a region containing many mineral deposits and mining districts that have produced a wide variety of metals.

Near Patterson Creek, tributary to the Pahsimeroi, the Blue Wing District has been the second largest producer of tungsten in Idaho. The Ima mine produced more than 300,000 units before closing in 1957. About 1,000 tons of copper have come from this district. There are also occurrences of copper, lead, zinc, and other metals. The Eureka District in the vicinity of Salmon, Idaho, has produced about 2,200 tons of copper from ores containing small amounts of gold. A few small uranium prospects and some undeveloped iron deposits are present in this district. Near the headwaters of the Lemhi River, on upper Texas Creek, the Texas and Spring Hill districts around Gilmore produced about 600 tons of copper, 21,700 ounces of gold, more than 100,000 ounces of silver, more than 50,000 tons of lead, and more than 1,000 tons of zinc. On the upper Lemhi River, near Timber Canyon and Eight-mile Creeks, the Junction, or Leadore District has produced more than 100,000 ounces of silver, more than 1,000 tons of lead and more than 1,000 tons of zinc along with minor

amounts of gold. Near the middle Lemhi River, in the vicinity of Tendoy, the McDevitt District has produced 2,500 tons of copper, and some gold from ores containing copper and gold. The headwaters of Agency Creek are probably the largest domestic deposits of thorium and rare earths. Undeveloped iron ore deposits are also found in this district. The lower Lemhi River and its tributaries, between Tendoy and its confluence with the Salmon River, the Eldorado and other districts have produced about 500 tons of copper and some gold from copper-gold ores similar to those of the McDevitt District. Placer deposits on Carmen Creek have produced 24,500 ounces of gold.

In the headwaters of the North Fork Salmon River, the Gibbonsville District has produced about 100,000 ounces of gold from placer and lode deposits. The Mineral Hill and Indian Creek districts near Shoup, have produced 87,000 ounces of gold mostly from lode deposits. The district contains potentially important resources of columbium and tantalum and occurrences of copper, cobalt, and thorium. The Mackinaw District near Leesburg, Idaho, at the head of Moose, Beaver, and Napias creeks, has produced about 271,000 ounces of gold mostly from placer with some lode deposits and contains occurrences of tungsten and copper. The Blackbird District, near the head of Panther Creek and on Deep Creek, has been the most productive mining district in the Salmon River drainage in recent time. From 1951 to the present, this district has produced nearly 7,000 tons of cobalt, 31,500 tons of copper, and 14,000 ounces of gold. It was the leading cobalt producer in the United States from 1951 to 1959, and the leading copper and gold producer in Idaho from 1957-1960. The Yellow Jacket District, near the head of Yellow Jacket Creek, tributary to Camas Creek, has produced about 25,000 ounces of gold from lode deposits. At the headwater of the Middle Fork of the Salmon on Bear Valley Creek, the Bear Valley placer deposits have produced titantium minerals, zirconium mineral, magnetic iron, garnet, and radioactive black sands that contain tantalum and columbium, thorium, and uranium.

Two dredges operated between 1955 and 1959. The dredges ceased operation in 1959 at the termination of a Government contract, and large reserves of unmined placer remain in the valley. Almost the total domestic production of columbium and tantalum has come from this valley. The Loon Creek District on Loon Creek, tributary to Warm Springs Creek that empties into the Middle Fork, has produced about 1,000 tons of copper and 40,000 ounces of gold. Near the head of Monumental Creek, a tributary to Big Creek, the Thunder Mountain District has produced about 17,500 ounces of gold and considerable silver, mostly from lode deposits. Near the head of Big Creek, the Ramey Ridge and Edwardsburg districts have produced about 41 tons of copper, together with considerable gold. There are other metals occurring in these districts. On the upper part of the South Fork of the East Fork and on Johnson Creek, the Yellow Pine District

has produced more than 5,000 tons of antimony, 850,000 units of tungsten, 310,000 ounces of gold, more than 100,000 ounces of silver, and 11,000 flasks of mercury. This district was the country's chief source of tungsten during World War II, and the district contains the largest known potential resources of antimony in the United States.

The upper Salmon River and tributaries from its headwaters to the mouth of the Pahsimeroi River is a widely mineralized area and contains several presently active mining enterprises.

The Stanley District, in the vicinity of Stanley Lake, has produced a small amount of gold mostly from placer deposits, and a few hundred tons of uranium ore from lode and bedded deposits. The Yankee Fork District, on the Yankee Fork near Custer, Idaho, has produced about 266,000 ounces of gold from lode and placer deposits, more than 5 million ounces of silver, and more than 1,000 tons of lead from lode deposits. The Bayhorse District, along the Salmon River and its tributaries from the mouth of Warm Springs Creek downstream to the mouth of Challis Creek, has produced 5 million or more ounces of silver, more than 50,000 tons of lead, more than 50,000 tons of zinc, 2,000 tons of copper, and more than 1,000 units of tungsten. The East Fork District, on the upper East Fork and its tributaries has produced 100,000 or more ounces of silver with some gold.

Some metallic minerals have been produced in the Upper Palouse River drainage in Latah County, Idaho. On the North Fork Palouse River, the Hoodoo District has produced about 17,000 ounces of gold from placer deposits; 1,000 ounces of silver, and 70 tons of copper, and a small amount of gold has come from lode deposits nearby. Most of the placer deposits have been exhausted; sporadic attempts recently to recover gold have been unprofitable. Some gold has been produced from placers on Gold Creek, a tributary to the Palouse River, and an undeveloped magnetic iron deposit occurs on Gold Hill near Gold Creek.

Nonmetals

A large variety of nonmetallic mineral deposits exist in Subregion 6; however, except for sand-gravel and stone used locally for road and building materials, refractory clays, and mica, only a small amount of nonmetals have been produced due largely to the minor demand within marketing range of the deposits.

On the main stem of the Snake River, the principal deposits are the sand-gravel terraces and bars bordering the river. These deposits are exploited on both sides of the river for building materials in the vicinity of Lewiston, Clarkston, and Asotin. Also

on the Snake, a large deposit of limestone occurs at the mouth of the Grande Ronde River on the Washington side and, less extensively, across the Snake River in Idaho. This deposit has been tested by a large cement company with plans for future use as cement rock. This part of the Snake River drainage is largely covered by Columbia River basalt, used extensively for road surfacing material.

The Palouse River drainage contains some important high silica and alumina clay deposits. Deposits near Colfax and Palouse, Washington, and at Onaway near Potlatch, Idaho, have some known past production; however, larger clay deposits exist on the South Fork of the Palouse River drainage near Moscow, Idaho. The Canfield-Rogers deposit near Moscow is estimated to cover about 100 acres, and contains more than 6 million tons of clay with more than 20 percent alumina content. An estimated 5,000 to 7,000 tons of clay have been produced from this deposit for firebrick manufacture.

A continuation of this clay-bearing belt is found near Bear Creek and the Potlatch River, tributaries to the Clearwater River, and near Troy, Helmer, and Bovill, Idaho. The clay deposits near Helmer, Idaho, are being mined for firebrick manufacture at Troy, and deposits near Bovill and Stanford, Idaho, are being mined and treated in a clay plant at Bovill. The total clay reserves in this belt across Latah County are estimated to be in the order of 465 million dry tons. These clays have been successfully tested for recovery of alumina by the Anaconda Company and might be an important potential for future production of aluminum.

The Mica Mountain (Avon) District near the East Fork of Big Bear Creek, a tributary to the Potlatch River, contains important mica deposits. The Muscovite mine was the largest mica producer in Idaho, and one of the largest in the United States. It was first opened in 1888 and since then has produced about 1,900 tons of crude mica. Several other mines and prospects in the district have produced substantial amounts of mica in the past. In addition to mica, the district has also produced about 2,000 pounds of beryl concentrates.

Several limestone deposits have been productive in the past along the lower part of the Clearwater River and its tributaries. These include a deposit of Bedrock Creek near Agatha, Idaho, a deposit on Mill and Mission creeks, tributaries to Lapwai Creek near Jacques Station, and two or three deposits near Orofino where a cement plant formerly operated.

The Maggie Creek District at the head of Maggie Creek, a tributary to the Middle Fork of the Clearwater and near Woodrat Mountain, contains enormous resources of Kyanite and some asbestos minerals that are as yet undeveloped. A major mining company has obtained leases and made plans for future development of the Kyanite.

In the Gravel Range District on the upper part of Camas Creek drainage, a tributary to the Middle Fork of the Salmon River and near Meyers Cove, Idaho, fluorspar deposits have been developed. During the short period of production, 1951-1953, about 11,000 tons of fluorspar was produced. On the Salmon River near Big Squaw Creek, a large undeveloped fluorspar deposit has been prospected. Also, fluorspar deposits occur in the Bayhorse District near Challis. These deposits contain large resources but have only produced about 600 tons of fluorspar. A possibly important deposit has also been prospected near Stanley on the upper Salmon River.

Garnet Sands have been produced from placer deposits in Bear Valley and from Ruby Meadows in the Warren District.

Mineral Fuels

No mineral fuel deposits of economic importance occur. Lignite coal beds occur near Pollard Creek about 2 miles from Salmon, Idaho. Some coal was mined for local use, but it is of very poor grade. Coal beds also occur on Orofino Creek and nearby in the Clearwater Canyon; the coal is of inferior quality and none has been produced commercially. No oil or gas has been produced.

Present Mineral Industry and Outlook for the Future

Metals

Gold Of the 13 principal gold producing counties in Idaho, five are in the Lower Snake Subregion. Currently, the gold production in the United States is at an alltime low (the total gold production in Idaho for 1966 was only 5,056 ounces valued at 177,000). This low output is due in part to the imbalance between the controlled price of gold at $35 an ounce and costs of production.

Present gold production is chiefly that recovered as a byproduct from ores containing copper, cobalt, silver, lead, and zinc. The Calera mine in the Blackbird District, Lemhi County, and the Clayton mine in the Bayhorse District, Custer County are the principal byproduct-gold producers. With a change in the unfavorable economic climate for gold similar to that during the 1930's and early 1940's, gold production would doubtless increase substantially.

Silver Silver production is mostly from the Clayton mine, Custer County. This mine produced 144,275 ounces of silver in 1964 and the total production of Custer County in 1964 was 164,325 ounces.

Currently, much interest in silver production has been caused by the decreasing world stocks of silver and the recent price increase. Exploration projects have been active in the Texas District, Lemhi County, and in other parts of the subregion. The Texas, Yankee Fork, and Bayhorse districts have the greatest future potential. A further increase in price would result in increasing activity.

<u>Copper</u> The principal copper producer is the Calera mine, Lemhi County. Production is on a much lower scale than during the period 1951-1959. The Blackbird, Eureka, and McDevitt districts all in Lemhi County and the Bayhorse and Loon Creek districts in Custer County have the greatest potential for future copper production.

<u>Lead and Zinc</u> Clayton mine, Custer County, is the principal lead and zinc producer. In 1964 it produced 689 tons of lead and 103 tons of zinc. The Bayhorse, Yankee Fork, and Texas districts have the greatest future potential for lead and zinc production.

<u>Cobalt</u> The Blackbird District, Lemhi County, contains one of the world's largest resources of cobalt along with a minor amount of nickel and bismuth. During the period 1951-1959 nearly 14 million pounds of cobalt were produced at the Calera mine. Currently, the mine is producing copper but the metallurgical difficulties and cost of separating the cobalt from the copper makes it uneconomic to recover cobalt at present prices. Future production will depend on improved metallurgical processes, or unavailability of cobalt from world sources.

<u>Antimony</u> The Yellow Pine District, Valley County, was the major producer of antimony from stibnite ores from 1932 to 1952. Low market prices and declining grade were responsible for closing the largest antimony producer in the district in 1952. Large reserves of antimony ores remain in the district and production will likely increase when economic conditions are more favorable, or other world sources become unavailable.

<u>Tungsten</u> Idaho has produced 10 percent of all tungsten produced in the United States since 1900, and nearly all of this has come from this subregion. The Ima mine, in the Blue Wing District, Lemhi County, a steady producer from 1936 to 1957, and the Yellow Pine mine between 1942-1944, accounted for most of the tungsten output. These mines are both closed at the present time. The Thompson Creek mine in the Bayhorse District is the only active tungsten mine at the present time. There is a good potential for

future production in the Yellow Pine and Big Creek District, Valley County; Tenmile and Warren districts, Idaho County; Mineral Hill, Blue Wing, Bayhorse, and East Fork districts in Lemhi County. Resources are regarded as very large.

Mercury The mercury deposits in the Yellow Pine District, Valley County, have accounted for about 50 percent of all the mercury produced in Idaho. The Hermes mine produced 10,700 flasks of mercury between 1942 and 1948. A few hundred flasks have been produced since 1948. A small beneficiation plant is currently operating. Considerable resources of mercury-bearing rock remain in the Yellow Pine District; however, it seems unlikely at the present time that future production will equal that of the past.

Iron Ore No iron ore has been produced for use in the iron and steel industry. Small quantities of iron ore have been shipped from deposits in Lemhi and Idaho counties for other uses such as portland cement manufacture and heavy aggregate in concrete. The principal iron deposits are in Lemhi, Custer, Idaho, and Clearwater counties; most are relatively small. It is unlikely that iron ore will be produced in significant tonnages in the future unless a steel mill is established much nearer to the deposits than those now in operation.

Uranium and Thorium and Rare Earth Minerals Uranium and thorium, both radioactive minerals, were subject to a great deal of prospecting activity when the Government was offering special incentives for discovery and development of radioactive deposits. Thorium with associated rare earth minerals occurs in the placer deposits of Bear Valley, and in monazite deposits of Ruby Meadows; and some production has come from these sources. However, veins containing thorium and rare earth minerals in the Lemhi Pass area of Lemhi County are probably one of the greatest known resources of thorium in the United States. A small production has come from these deposits, but when market demand warrants development, the Lemhi Pass deposits will become a major source of thorium. Some thorium occurrences are also found in the Indian Creek District near Shoup.

Uranium has not been discovered in substantial deposits. Several prospects were investigated in Lemhi County a few years ago, and a small amount of uranium ore was shipped. No uranium mines are operating at the present time, and it is unlikely that a substantial uranium deposit will be developed. Some uranium will be produced in the future as a byproduct from mining of Bear Valley and other black sand placers.

Columbium and Tantalum Columbium and tantalum are generally found together in nature as minerals containing some iron, manganese, uranium, and rare earths. Idaho has been the largest producer of columbium and tantalum in the United States. Production during the period 1956-1959, mostly from the Bear Valley placers on Bear Valley Creek, Valley County, Idaho, accounted for at least 95 percent of the domestic production. Large reserves of these metals are still present in the placer deposits remaining in Bear Valley and will be available when needed for strategic purposes.

Nonmetals

Sand and Gravel Sand and gravel occurs generally as alluvial terraces and bars in or bordering the rivers and tributary creeks. Where easily accessible the deposits are used for road material and, when close to a market, are used for aggregates and building materials. Relatively permanent sand-gravel operations are limited to deposits near urban centers, such as Lewiston-Clarkston and Orofino. Enormous quantities of gravel and some sand exist as dredge tailings at the former gold placer operations and minor amounts have been used for roads. Counties showing sand and gravel as first in order of value of mineral production for 1965 are: Franklin, Whitman, and Asotin counties, Washington, and Idaho County, Idaho. Future production will probably continue much in the order of the past.

Stone Stone quarries for road materials and aggregate are confined principally to areas covered by Columbia River basalt in the northwestern part of the subregion. Perhaps 60-75 percent of all road materials produced in this part of the subregion comes from basalt quarries. These are generally located where convenient and accessible to the job and are only worked sporadically when need arises for the material.

Limestone is produced at a quarry and plant on Mission Creek in Lewis County; the plant operates sporadically. Other limestone deposits have been worked near Orofino and a very large deposit exists in the Snake River Canyon near the mouth of the Grande Ronde River. Future limestone production depends largely on development of nearby markets. In 1965, counties in the subregion showing stone as first in order of value for mineral production are: Adams, Garfield, and Columbia counties, Washington; and Nez Perce, Lewis, Clearwater, and Valley counties, Idaho.

Clay The clay products industry is located entirely in Latah County, Idaho, where clay ranks first in value of mineral

production for 1965. A clay plant near Bovill, Idaho, produces paper clay (kaolin), silica sand, and is experimenting with other products from the clay deposits mined nearby. Another company manufactures firebrick and other refractory products at Troy, Idaho, from their clay pits at Helmer. The Anaconda Company has made successful pilot plant tests using Latah County clays to produce alumina for making aluminum; therefore, the clays represent a possible future source for aluminum. A clay products industry also exists in Spokane County, Washington, but the clay deposits and manufacturing plant are in Subregion 1. Less important clay deposits occur in other counties, some of which were productive in the past. It is likely that the very large reserves of high grade clay in Latah County will attract more producers in the future and that the clay industry will expand.

Mica Mica has been produced only in Latah County, Idaho. A small production of scrap mica was made at the Muscovite mine in 1964. The mine is currently closed down. This district has been one of the largest producers of sheet and scrap mica in the United States and resources are probably adequate for a substantial future production when economic or other conditions encourage further output.

Kyanite No kyanite has been produced; however, interest in a very large deposit in Idaho County indicates a probable output of kyanite in the near future. Reserves are sufficient for a sustained production over a period of many years.

Fluorspar Principal production of fluorspar has come from Lemhi and Custer counties. Output was during the period 1951-1953. Since that time economic conditions have deterred continued operations. Adequate reserves remain in high grade deposits and will be mined when profitable to do so.

Garnet Garnet is produced largely as a byproduct of other minerals produced from heavy sands in the Bear Valley placer deposits. A very limited market prevents a large output from the many areas where garnet is found.

SUBREGION 7
MID COLUMBIA

ABSTRACT

The Mid Columbia Subregion is one of the larger subregions in the Columbia-North Pacific study area. It includes central and north-central Oregon and southern Washington.

About 44 percent of the land is forest covered and devoted to dual forest and range use. Forested areas occur mainly along the west side at elevations mostly above 3,500 feet above sea level and along the crest of the Ochoco and Blue Mountains that extend generally from the southwest to the northeast corner. A basalt plateau with deeply entrenched canyons and high promontories breaking the continuity of the surface topography is the dominate feature. Soils are formed mostly in residuum/colluvium from the basic igneous bedrock mixed in some areas with volcanic ash overburden or with glacial terraces from individual mountain glaciers in the western part of the subregion. In the northeast part the bedrock is covered with silty loess. Precipitation varies from 18 to 60 inches, falling as snow and rain from November through April. The frost-free period normally ranges from less than 60 to 120 days. Problems of use relate to shallow, rocky soils on steep and very steep slopes that are quite erodible, and a short growing season.

Approximately 33 percent of the land has a grass/browse or grass/sagebrush cover and is used as rangeland. It generally borders the forest covered areas at lower elevations and occupies the shallow, rocky soil areas and steep slopes interspersed among the cropland areas. The soils are formed in residuum/colluvium from sedimentary or basaltic bedrock mixed in different areas with volcanic ash or loess. Precipitation over the grassland area normally ranges from 8 to 18 inches, falling as rain and snow from November through March. Normally the frost-free periods extend from 80 to 210 days. Problems of use relate to shallow, rocky, sandy, or clayey soils, and steep slopes.

The 20 percent of land that is under cropland use consists of:

1. Irrigated cropland that occurs mostly on outwash plains and terraces, with one area adjacent to the Columbia River at elevations of 250 to 1,500 feet and other areas close to Bend-Redmond and Madras at elevations of 2,000 to 3,500 feet. Soils are generally sandy or loamy, gravelly, and frequently only moderately deep. Precipitation over this area normally ranges from 8 to 18 inches

and the frost-free period from 80 to 210 days. Problems of use relate to the gravelly, sandy soils and restricted soil depths.

2. Dryland cropland includes an important part of the rich wheat producing land in the subregion. It consists of deep and very deep silty soils formed in undulating hills of loess deposited on the basaltic lava plains that occur in the north-central part. Most of this area is at elevations of 1,500 to 3,500 feet above sea level. Precipitation normally varies from 12 to 18 inches, falling mostly as rain and snow from November through March. The frost-free period is normally from 90 to 210 days. Problems of use relate to droughtiness and soil erosion on steep slopes. Some scattered dryland areas occur at elevations above 3,500 feet and grow mostly pasture, hay, and some grain crops.

The 3 percent of the land defined as other land use consists mostly of barren lava rock areas associated with rangeland use and in alpine areas associated with the forest land.

A large part of Subregion 7 is in the Columbia Basin physiographic province and is covered by basalt and other volcanic materials of Tertiary and Quaternary age. Construction materials such as sand and gravel and stone are the principal mineral products.

The southeastern corner of the subregion extends into the Blue Mountains province in the upper John Day River drainage, Grant County. Most of the metal deposits (except mercury) are found in this area. Gold and silver have been the principal metals produced with minor amounts of copper, lead, and zinc. The largest gold and silver production in Oregon in recent years has come from the Buffalo mine in Grant County and the Oregon King mine in Jefferson County. An area near Canyon City contains a number of chromite deposits from which has come a small production.

Most of the mercury deposits are found in and near the Ochoco Mountains in Crook and Jefferson counties. The Horse Heaven mine has produced about 17,000 flasks of mercury and was one of the largest mercury mines in Oregon. It has been closed for several years. Other mercury mines have produced a few thousand flasks.

The total watershed area consists mostly of land, with only about one-half of 1 percent water. Table 154 shows the land, water, and total watershed acreages by states and counties. Except for table 154, only the areas of land will be recorded in acreages throughout the following discussion.

Table 154 - Areas by State and County, Subregion 7, 1967

State and County	Water Area Sq.Mi.	Water Area Acres	Land Area[1/] Sq. Mi.	Land Area[1/] Acres	Total Area Sq. Mi.	Total Area Acres
Oregon						
Crook	1.9	1,200	2,962.8	1,896,200	2,964.7	1,897,400
Deschutes	49.4	31,600	2,661.7	1,703,500	2,711.1	1,735,100
Gilliam	7.8	5,000	1,210.2	774,500	1,218.0	779,500
Grant	0.4	200	3,687.8	2,360,200	3,688.2	2,360,400
Harney	0.0	0	94.4	60,400	94.4	60,400
Hood River	7.2	4,600	528.8	338,400	536.0	343,000
Jefferson	1.1	700	1,793.9	1,148,100	1,795.0	1,148,800
Klamath	17.0	10,900	765.0	489,600	782.0	500,500
Lake	0.0	0	117.8	75,400	117.8	75,400
Morrow	5.8	3,700	2,059.2	1,317,900	2,065.0	1,321,600
Multnomah	0.1	100	0.6	400	0.7	500
Sherman	7.6	4,900	826.4	528,900	834.0	533,800
Umatilla	18.6	11,800	3,172.0	2,030,100	3,190.6	2,041,900
Union	0.1	100	25.0	16,000	25.1	16,100
Wallowa	0.0	0	15.0	9,600	15.0	9,600
Wasco	9.3	6,000	2,382.7	1,524,900	2,392.0	1,530,900
Wheeler	0.0	0	1,707.0	1,092,500	1,707.0	1,092,500
Total Oregon	126.3	80,800	24,010.3	15,366,600	24,136.6	15,447,400
Washington						
Benton	31.1	19,900	867.3	555,100	898.4	575,000
Columbia	0.0	0	399.0	255,400	399.0	255,400
Klickitat	34.7	22,200	1,831.9	1,172,400	1,866.6	1,194,600
Skamania	0.7	500	566.2	362,300	566.9	362,300
Walla Walla	3.2	2,000	1,014.4	649,300	1,017.6	651,300
Yakima	0.3	200	720.5	461,100	720.8	461,300
Total Washington	70.0	44,800	5,399.3	3,455,600	5,469.3	3,500,400
Total Subregion	196.3	125,600	29,409.6	18,822,200	29,605.9	18,947,800

1/ The term "land" is defined to include all water bodies under 40 acres and streams under one-eighth mile in width.
Source: U.S.D.A. Conservation Needs Inventory adjusted to U.S. Census.

LAND

Factors of major importance to the land resource are: the ownership status, the soils, and the present use. The combination of these factors greatly influences the present and future utilization of the land resource.

Land Ownership

The Mid Columbia Subregion contains a little over 18.8 million acres. Private ownerships make up the largest group with 10.8 million acres or 58 percent of the total land area. The Federal Government owns nearly 7.5 million acres or 40 percent of the total. State, county, and municipal ownership makes up the balance.

Over 4.5 million acres of the public lands are national forest. Nearly 1.7 million acres are Public Domain. Slightly less than 250,000 acres are other mixed Federal holdings within the Departments of the Interior and Defense. State, county, and municipal governments own over a half-million acres. Slightly over a million acres are Indian Reservation lands.

Table 155 - Land Ownership Acreage, Subregion 7, 1966

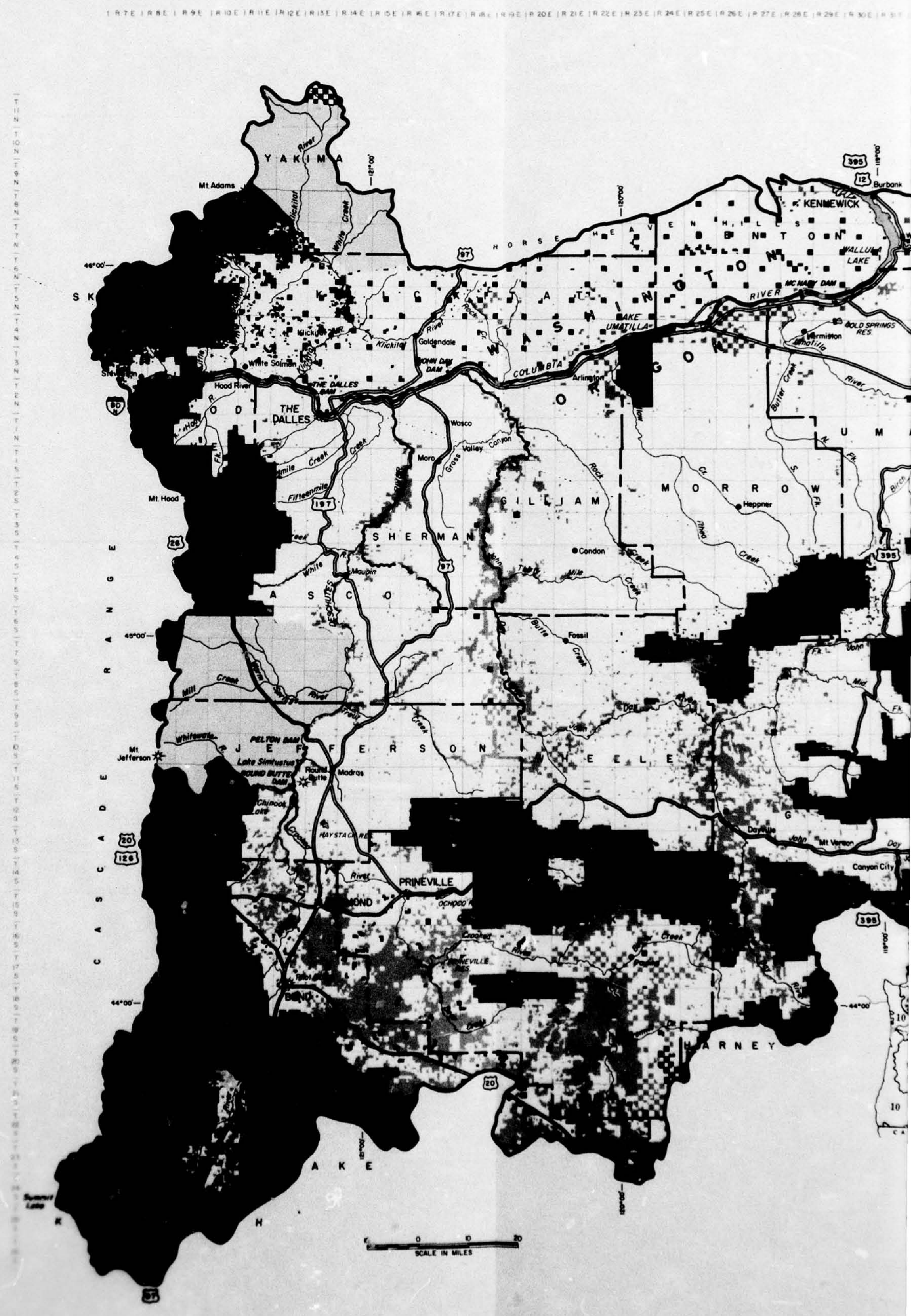
Administering Agencies	Washington	Oregon	Total
		(1,000 acres)	
Department of Agriculture			
Forest Service	408.9	4,133.8	4,542.7
Other Agriculture	-	-	-
Subtotal	408.9	4,133.8	4,542.7
Department of the Interior			
Bureau of Land Management	20.1	1,654.5	1,674.6
Bureau of Indian Affairs 1/	350.0	657.4	1,007.4
National Park Service	.1	-	.1
Fish & Wildlife Service	2.6	.5	3.1
Bureau of Reclamation	-	74.7	74.7
Other Interior	2.2	1.1	3.3
Subtotal	375.0	2,388.2	2,763.2
Department of Defense	57.3	101.9	159.2
Other Federal	.2	.7	.9
Federal Subtotal	841.4	6,624.6	7,466.0
State	241.8	158.0	399.8
County	3.1	104.4	107.5
Municipal	5.4	16.4	21.8
Public Non-Federal Subtotal	250.3	278.8	529.1
Total Public	1,091.7	6,903.4	7,995.1
Total Private	2,363.9	8,463.2	10,827.1
Grand Total	3,455.6	15,366.6	18,822.2

1/ Private lands held in trust by the Federal Government.
Source: General Services Administration Real Property Owned by the United States as of June 30, 1965, adjusted by the Land and Minerals Work Group.

Table 155, Land Ownership, and figure 30, Land Ownership Map, show this information in more detail.

Soils

Figure 31, Soil Associations Map, shows the location and relative extent of each soil association. The associations are numbered in a general relationship to the position in the landscape. Thus bottomlands and low terraces have the lowest numbers and alpine areas have the highest. The name of each association relates to the soil series representing general kinds of soil that are most extensive in the landscape. Wherever possible, established soil series are used in the name; however, where the soil series do not have classification status the soil series name is not recorded. Generally up to 15 percent of any soil association in known areas may consist of inclusions of soils other than those identified. Such inclusions may be similar soils or they may be highly contrasting. However, in many high mountainous areas where detailed knowledge about the area is incomplete, extensive areas are included


YAKIMA
Mt. Adams
KENNEWICK
Burbank
HORSE HEAVEN HILLS
BENTON
WALLULA LAKE
MC NARY DAM
COLD SPRINGS RES.
Hermiston
KLICKITAT
WASHINGTON
LAKE UMATILLA
Goldendale
JOHN DAY DAM
COLUMBIA
Arlington
OREGON
White Salmon
Hood River
THE DALLES DAM
THE DALLES
Wasco
Moro
GILLIAM
MORROW
Heppner
Mt. Hood
SHERMAN
Condon
Maupin
WASCO
Fossil
Mill Creek
PELTON DAM
Mt Jefferson
JEFFERSON
Lake Simtustus
ROUND BUTTE DAM
Round Butte
Madras
Chinook Lake
HAYSTACK RES.
PRINEVILLE
OCHOCO
PRINEVILLE RES.
BEND
HARNEY
Dayville
Mt Vernon
Canyon City
CASCADE RANGE
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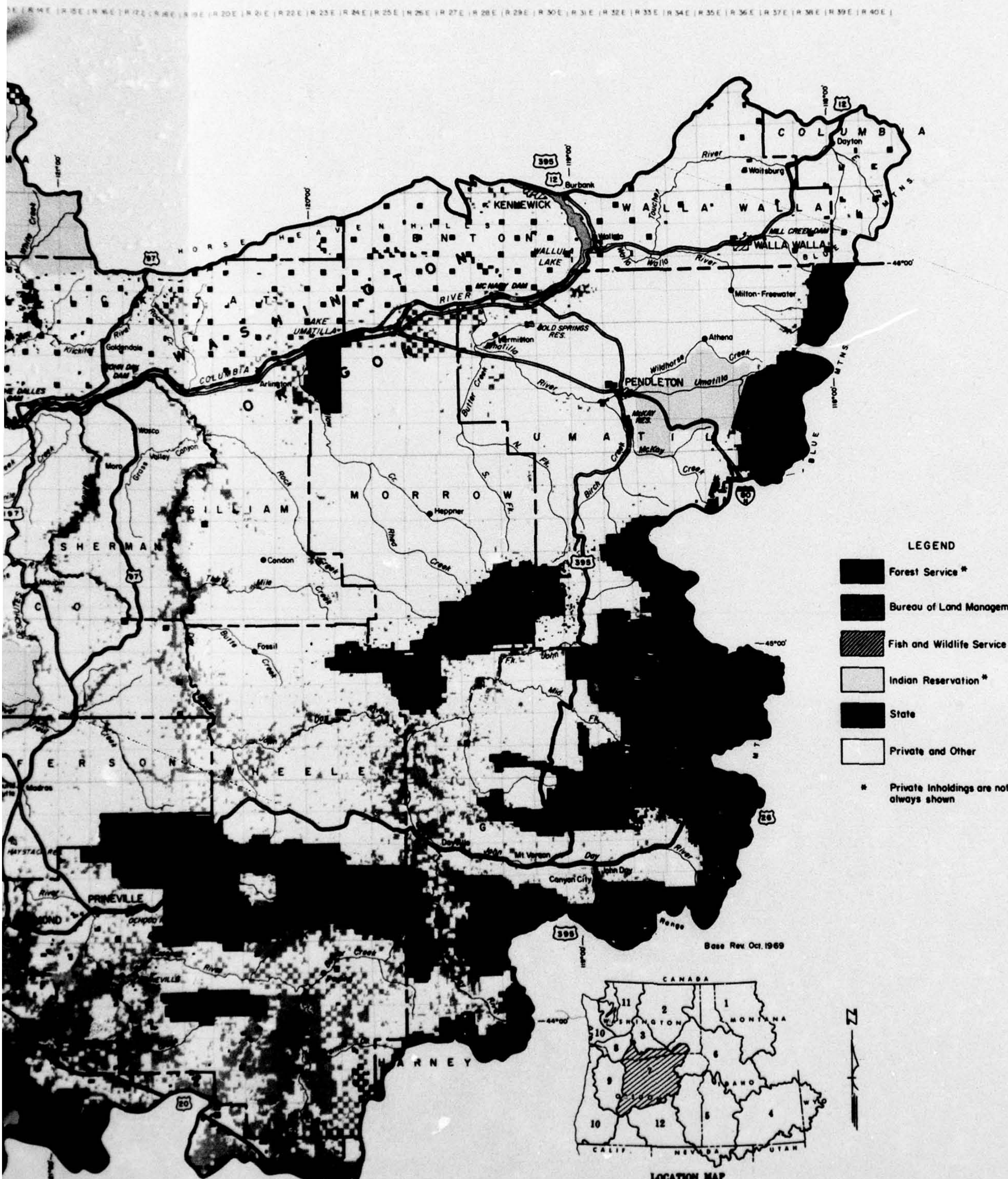

COLUMBIA–NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

LAND OWNERSHIP

MID COLUMBIA, SUBREGION 7

1968

FIGURE 30

LEGEND REVISED 1970

LEGEND

Soil Associations Map Symbol *	Name of Association
	Generally silty and sandy soils formed in alluvial sediments on bottomlands and low terraces.
1	Ochoco - Prineville
	Generally silty and sandy soils with coarse fragments formed in glacial materials on terraces, plains and mountains.
2	Quincy - Burbank
3	Warden - Ephrata
	Generally silty and clayey soils with somewhat restricted subsoil and substrata permeability formed in stratified sediments on terraces, basins and hilly upland.
4	Hood - Parkdale
5	Chenoweth - Cherryhill
6	Tub - Simas
7	Fopiano - Damon
	Generally silty or sandy soils formed in wind deposited or wind worked sediments on hilly uplands.
8	Walla Walla - Starbuck
9	Ritzville - Starbuck
10	Shano - Starbuck
11	Waha - Athena
	Generally silty soils formed in materials mixed with rocky residuum-colluvium from basic rock types on plateaus, canyons and mountains.
12	Olympic - Chemawa
13	Skyline - Frailey
14	Condon - Bakeoven
15	Lickskillet - Nansene
16	Hager - Deschutes
17	Dominantly Cryumbrepts
	Generally sandy soils formed in materials mixed with volcanic ash or pumice on terraces, foothills, plateaus and mountains.
18	Deschutes - Redmond
19	Madras - Agency
20	Rockland - Underwood
21	Cinebar - Cispus
22	Dominantly Argixerolls
23	Dominantly Vitrandepts
24	Dominantly Cryorthents
25	Dominantly Cryandepts
26	Dominantly Cryandepts
	Generally silty soils formed in materials mixed with gravelly residuum-colluvium from sedimentary bedrock on mountains.
27	Venator - Izee

** Symbols are non-conotative and consistent only within each subregion. To compare delineations from one subregion to another refer to the name of the Soil Association.*

NOTE: The Soil Association name may include a series that does not fit the Soil Associations Group description. The Soil Association name is based on dominant series. The dominant of five series may be only 30 percent of the Soil Association. Thus a clayey textured soil series may be included in a group accurately described as generally silty and sandy in texture.

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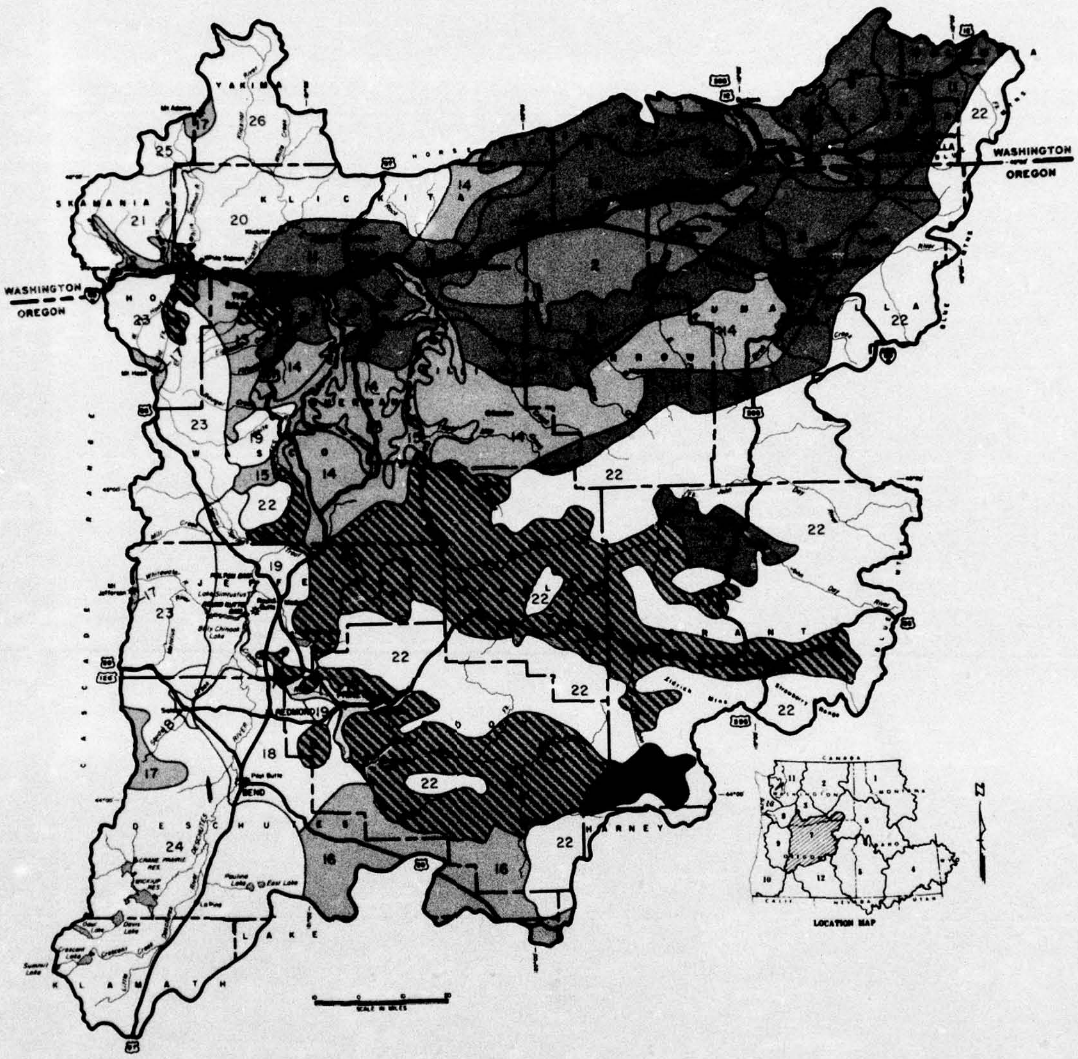

COLUMBIA–NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

SOIL ASSOCIATIONS

MID COLUMBIA, SUBREGION 7

FIGURE 31

2

within delineations and inclusions of other soils may exceed the 15 percent general average.

Table 156 contains information about each soil association shown on figure 31. The symbol listed in the second column on the table is the same symbol shown on the soil association map. The table is organized to show land characteristics and the characteristics, qualities, and some interpretations of soil series representing the dominate and the contrasting kinds of soil in each association. The first six columns show some general land characteristics for each soil association. The next 11 columns show characteristics (permanent soil facts) of individual key soil series that represent dominant and contrasting soils. The following four show qualities inferred from the characteristics of these soils and the last four columns show interpretations concerning agricultural use based upon the foregoing soil characteristics and qualities. All of the representative soil series listed have status in classifications. A blank space in the soil series column indicates that the soil series name has no classification status.

The "soil groups" column contains soil associations that have broad similarities in some important characteristics frequently identified with a position on the landscape.

The "percentage of association" column shows the extent of each soil in an association. Differences of the total soil percentage in each association from 100 percent are inclusions of other soils and land types. For example, soil association 12 lists a total of 75 percent. Knowledge of this area is limited so that 25 percent of the area consists of inclusions of soils that are not defined.

Terms listed for permeability of water through the subsoil and permeability of substratum are:

Very rapid: Over 10 inches per hour.
Rapid: 5 to 10 inches per hour.
Moderately rapid: 2.50 to 5 inches per hour.
Moderate: 0.8 to 2.5 inches per hour.
Moderately slow: 0.2 to 0.8 inches per hour.
Slow: 0.05 to 0.2 inches per hour.
Very slow: Less than 0.05 inches per hour.

Terms listed for total available water-holding capacity are:

Low: Less than 6 inches in profile.
Medium: 6 to 10 inches.
High: More than 10 inches in profile.

The irrigated capability subclasses are an interpretation of limitations and hazards of using only presently irrigated lands. Many areas not presently irrigated may be potentially irrigable but are not included in this classification.

A dash indicates that a column does not apply or there is insufficient data to complete it.

Table 157 shows the acreage and proportionate extent of the soil association by states.

Table 157 - Soil Association Acreage by States, Subregion 7, 1966

Soil Association					
Map Symbol	Name	Oregon	Washington (1,000 acres)	Total	Percent
1	Ochoco-Prineville	60.0	-	60.0	0.3
2	Quincy-Burbank	550.0	-	550.0	2.9
3	Warden-Ephrata	8.0	180.0	188.0	1.0
4	Hood-Parkdale	50.0	-	50.0	0.3
5	Chenoweth-Cherryhill	50.0	-	50.0	0.3
6	Tub-Simas	2,400.0	-	2,400.0	12.8
7	Fopiano-Damon	195.0	-	195.0	1.0
8	Walla Walla-Starbuck	815.0	290.0	1,105.0	5.9
9	Ritzville-Starbuck	600.0	458.0	1,058.0	5.6
10	Shano-Starbuck	-	557.6	557.6	2.9
11	Waha-Athena	715.0	390.0	1,105.0	5.9
12	Olympic-Chemawa	-	50.0	50.0	0.3
13	Skyline-Frailey	170.0	-	170.0	0.9
14	Condon-Bakeoven	1,360.0	115.0	1,475.0	7.8
15	Lickskillet-Nansene	370.0	-	370.0	1.9
16	Hager-Deschutes	750.0	-	750.0	4.0
17	Dominantly Cryumbrepts	125.0	25.0	150.0	0.8
18	Deschutes-Redmond	450.0	-	450.0	2.4
19	Madras-Agency	485.0	-	485.0	2.6
20	Rockland-Underwood	-	500.0	500.0	2.6
21	Cinebar-Cispus	-	240.0	240.0	1.3
22	Dominantly Argixerolls	3,528.6	160.0	3,688.6	19.6
23	Dominantly Cryumbrepts	1,020.0	-	1,020.0	5.4
24	Dominantly Xerosamments	1,540.0	-	1,540.0	8.2
25-26	Dominantly Cryandepts	-	490.0	490.0	2.6
27	Venator-Izee	125.0	-	125.0	0.7
Total Land Area		15,366.6	3,455.6	18,822.2	100.0

Source: National Cooperative Soil Survey.

Tables 156 and 157 show general as well as specific information about the characteristics, qualities, interpretation, and extent of the different soil associations in Subregion 7. About 45 percent of the soils are influenced by volcanic ash and pumice, due to the proximity to an adjacent source from various promontories in the Cascade Range. Much of this area occurs at high elevations under a forest cover and with climatic limitations for use and management. Over 20 percent of the soils have minor amounts of coarse fragments and moderately deep to very deep soils formed in hilly deposits of wind deposited silts. More than 20 percent of the soils are moderately to severely restricted in use by the presence of coarse fragments and over 14 percent of the soils formed in old lake-laid

Table 156 - Characteristics and Qualities of Representative Soils, Subregion 7 1/

Soil Association: Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage of Assn. 3/	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth
Moderately deep to very deep soils with loamy subsoils on nearly level slopes.	1	2,600-3,000	8-10	100-130	Cropland (pasture, hay, potatoes and corn) - 90% irrigated	Xerollic Durargids	Fine-loamy, mesic, mixed	Ochoco	23	Terraces	Alluvium	Loam	Clay loam	None	--	24-36" over hardpan
					Rangeland	Xerollic Durorthids	Coarse-loamy, mixed, mesic	Prineville	22	Terraces	Alluvium	Sandy loam	Sandy loam	None	--	48" over cemented calcareous material
						Aridic Cumulic Haploxerolls	Coarse-silty, mixed, mesic	Powder	15	Bottomlands	Alluvium	Loam	Loam	None	--	40"
						Xerollic Camborthids	Coarse-loamy, mixed, mesic	Metolius	12	Bottomlands	Alluvium	Sandy loam	Sandy loam	None	--	60"+
						Cumulic Haplaquolls	Fine-silty over sandy or sandy-skeletal, mixed, noncalcareous, mesic	Boyce	10	Bottomlands	Alluvium	Silty clay loam	Clay loam	None	--	48" over water table
						Aridic Calcic Argixerolls (Calcic Argixerolls)	Fine-loamy, mixed, frigid	Courtrock	8	Fans and terraces	Alluvium	Sandy loam	Sandy loam	None	--	60"+
Moderately deep to very deep soils with sandy and gravelly, loamy profiles on nearly level to moderate slopes.	2	250-1,100	7-10	150-200	Rangeland	Typic Torripsamments	Mixed, mesic	Quincy	30	Terraces	Sand	Loamy sand	Loamy sand	None	--	60"+
					Cropland (hay, pasture, cereals & row crops)-mostly irrigated	Typic Torripsamments	Mixed, mesic	Burbank	20	Terraces	Alluvium	Loamy fine sand	Loamy fine sand	Gravel	60 below 20-40"	20-40" over gravel
						Xerollic Camborthids	Coarse-silty, mixed, mesic	Sagemoor	15	Terraces	Loess over lacustrine material	Silt loam	Silt loam	None	--	20-40" over compact sediment
						Xerollic Camborthids	Coarse-loamy, mixed, mesic	Sagehill	10	Terraces	Alluvium	Fine sandy loam	Silt loam	None	--	20-40" over compact silts
						Xerollic Durorthids	Sandy, mixed, mesic	Koehler	10	Terraces	Sand	Loamy sand	Loamy sand	None	--	20-40" over hardpan
						Xerollic Paleorthids	Coarse-loamy, mixed, mesic	Taunton	10	Terraces	Alluvium	Fine sandy loam	Very fine sandy loam	None	--	20-40" over hardpan

Table 156 - Characteristics and Qualities of Representative Soils, Subregion 7[1/]

Per-cent-age[5/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeability Subsoil	Soil Qualities and Interpretations: Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Range of: Major Capability Subclass: Irrigated[6/]	Major Soil Problems	Suitable Land Treatment and Structures
23	Terraces	Alluvium	Loam	Clay loam	None	--	24-36" over hardpan	Moderately slow	Impervious in hardpan	Good	Low	IIe,IIs IIIe IIIw IIIs	IIe,IIs IIIe IIIw IIIs	Erosion; moderately deep over hardpan; droughtiness	Cross-slope operations; residue mgmt; cropping sequence; pastureland mgmt; irrigation mgmt.
22	Terraces	Alluvium	Sandy loam	Sandy loam	None	--	48" over cemented calcareous material	Rapid	Slow	Good	Medium	IIe IIs IIIe IVe	IIe IIs IIIe IVe	Erosion; droughtiness	Cross-slope operations; residue mgmt; cropping sequence; pastureland mgmt; irrigation mgmt.
15	Bottomlands	Alluvium	Loam	Loam	None	--	40"	Moderate	Moderate	Good	High	IIe IIc	IIe IIc	Erosion; alkaline subsoil; droughtiness	Residue mgmt; cropping sequence; soil amendments; irrigation mgmt.
12	Bottomlands	Alluvium	Sandy loam	Sandy loam	None	--	60"+	Rapid	Rapid	Good	Low and medium	IIe, IIs IIIe IIIs IVe, IVs	IIe, IIs IIIe IIIs IVe, IVs	Erosion; sandy profile; droughtiness	Cross-slope operations; residue mgmt; cropping sequence; pastureland mgmt; irrigation mgmt.
10	Bottomlands	Alluvium	Silty clay loam	Clay loam	None	--	48" over water table	Moderately slow	Moderately slow	Poor	High	IIIw Vw	IIIw Vw	Flooding; high seasonal water table; alkaline soil	Flood protection; drainage; soil amendments; residue mgmt; cropping sequence; pastureland mgmt; irrigation mgmt.
8	Fans and terraces	Alluvium	Sandy loam	Sandy loam	None	--	60"+	Rapid	Rapid	Good	Medium	IIe IIs IIIe IVs VIe	IIe IIs IIIe IVs	Erosion; sandy profile; droughtiness	Cross-slope operations; cropping sequence; residue mgmt; pastureland mgmt; irrig. mgmt; rangeland management
30	Terraces	Sand	Loamy sand	Loamy sand	None	--	60"+	Very rapid	Very rapid	Excessive	Low	VIIe	IVs	Erosion; droughtiness	Rangeland mgmt; residue mgmt; irrigation mgmt.
20	Terraces	Alluvium	Loamy fine sand	Loamy fine sand	Gravel	60 below 20-40"	20-40" over gravel	Very rapid	Very rapid	Excessive	Low	VIIe	IVe	Erosion; moderately deep over gravel; droughtiness	Rangeland mgmt; irrigation mgmt; cross-slope opers; residue mgmt; cropping sequence
15	Terraces	Loess over lacustrine material	Silt loam	Silt loam	None	--	20-40" over compact sediment	Moderate	Very slow	Good	Medium and high	IVe VIe	IVe	Erosion; strongly alkaline lacustrine material below 20-40; droughtiness	Rangeland mgmt; irrigation mgmt; cross-slope opers; residue mgmt; cropping sequence
10	Terraces	Alluvium	Fine sandy loam	Silt loam	None	--	20-40" over compact silts	Moderate	Slow	Good	Medium and high	VIIe	IIs IIIe IVe	Erosion; moderately deep over compact silts; droughtiness	Rangeland management; irrigation mgmt; cross-slope operations; residue mgmt; cropping sequence
10	Terraces	Sand	Loamy sand	Loamy sand	None	--	20-40" over hardpan	Very rapid	Impervious in hardpan	Somewhat excessive	Low	VIIe	--	Erosion; moderately deep over hardpan; droughtiness	Rangeland management
10	Terraces	Alluvium	Fine sandy loam	Very fine sandy loam	None	--	20-40" over hardpan	Moderately rapid	Impervious in hardpan	Good	Low	VIIe	IVe	Erosion; moderately deep over hardpan; droughtiness	Rangeland mgmt; irrigation mgmt; cross-slope opers; residue mgmt; cropping sequence

2

Table 156 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth	Permeabili[ty] Subsoil
	3	500-700	6-7	160-200	Rangeland	Xerollic Camborthids	Coarse-silty, mixed, mesic	Warden	30	Terraces	Loess and sediments	Silt loam	Very fine sandy loam	None	--	60"+	Moderately rapid
					Cropland (alfalfa, potatoes, sugar beets, vegetables, grass seed, & fruit orchards)-irrigated(cereals)-dryland	Xerollic Camborthids	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Ephrata	20	Terraces	Alluvium over outwash	Loam or sandy loam	Gravelly loam	Sand and Gravel	20-35 below 10" in profile; 80 below 20-40"	20-40" over sand and gravel	Moderate
						Xerollic Camborthids	Coarse-silty, mixed, mesic	Sagemoor	15	Terraces	Loess over lacustrine material	Silt loam	Silt loam	None	--	60"+	Moderate
						Xerollic Camborthids	Coarse-loamy, mixed, mesic	Royal	15	Uplands	Mixed loess and sediments	Fine sandy loam	Fine sandy loam	None	--	60"+	Moderately rapid
						Typic Torripsamments	Mixed, mesic	Quincy	3	Duned terraces	Sand	Loamy fine sand	Loamy fine sand	None	--	60"+	Very rapid
						Xerollic Camborthids	Coarse-loamy, mixed, mesic	Prosser	3	Uplands (plateaus)	Loess over basic igneous rock	Silt loam	Silt loam	None	--	20-40" over bedrock	Moderate
Moderately deep and very deep soils with loamy subsoils on gentle to moderate slopes.	4	500-2,500	30-45	90-200	Cropland (fruit orchards)-irrigated	Ultic Haploxeralfs	Fine-loamy, mixed, mesic	Hood	30	Terraces	Lake sediments	Loam	Loam	None	--	60"+	Moderate
					Forest land[4/]	Umbric Vitrandepts	Ashy, mesic	Parkdale	25	Terraces	Volcanic ash & lake sediments	Loam	Loam	None	--	60"+	Moderate
						Ultic Haploxerolls	Coarse-loamy, mixed, mesic	Wind River	15	Terraces (dissected)	Lake sediments	Fine sandy loam	Fine sandy loam	None	--	40-60" over gravel or bedrock	Moderately rapid
						Aqueptic Fragiudalfs	Fine-silty, mesic, mixed	Wyeast	10	Bottomlands	Alluvium	Silt loam	Silt loam	None	--	40-60" over hardpan	Moderate

Table 156 - Continued

Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Range of: Major Capability Subclass: Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
Soil Characteristics								Soil Qualities and Interpretations					
Loess and sediments	Silt loam	Very fine sandy loam	None	--	60"+	Moderately rapid	Rapid	Good	Medium	IVe	IIe IIIe IVe	Erosion; sandy profile; droughtiness	Residue mgmt; cropping sequence; irrigation mgmt; rangeland mgmt.
Alluvium over outwash	Loam or sandy loam	Gravelly loam	Sand and Gravel	20-35 below 10" in profile; 80 below 20-40"	20-40" over sand and gravel	Moderate	Very rapid	Good	Low	VIe	IIs IIIe IVe	Erosion; gravelly profile; mod. deep over sand & gravel; droughtiness	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt; rangeland mgmt.
Loess over lacustrine material	Silt loam	Silt loam	None	--	60"+	Moderate	Very slow	Good	Medium and high	IVe	IIs IIIe IVe	Erosion; strongly alkaline lacustrine material below 30"	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt.
Mixed loess and sediments	Fine sandy loam	Fine sandy loam	None	--	60"+	Moderately rapid	Moderately rapid	Good	Medium	VIe VIIe	IIs IIIe IVe	Erosion; sandy profile; droughtiness	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt; rangeland mgmt.
Sand	Loamy fine sand	Loamy fine sand	None	--	60"+	Very rapid	Very rapid	Excessive	Low	VIIe	IVs	Erosion; sandy profile; droughtiness	Residue mgmt; irrigation mgmt; rangeland management
Loess over basic igneous rock	Silt loam	Silt loam	None	--	20-40" over bedrock	Moderate	Impervious	Good	Low and medium	VIe	IIs IIIe IVe	Erosion; moderately deep over bedrock; droughtiness	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt.
Lake sediments	Loam	Loam	None	--	60"+	Moderate	Moderate	Good	High	IIe,IIIe IVe VIIe	IIe IIIe IVe	Erosion	Cross-slope operations; residue mgmt; irrigation mgmt; forest land mgmt.
Volcanic ash & lake sediments	Loam	Loam	None	--	60"+	Moderate	Moderate	Good	High	IIe,IIIe VIe VIIe	IIe IIIe	Erosion; ashy profile	Cross-slope operations; residue mgmt;irrigation mgmt; forest land mgmt.
) Lake sediments	Fine sandy loam	Fine sandy loam	None	--	40-60" over gravel or *bedrock*	Moderately rapid	Very rapid or impervious	Somewhat excessive	Medium	IIIs IVs	IIIs IVs	Erosion; sandy profile	Cross-slope operations; residue management; irrigation management
s Alluvium	Silt loam	Silt loam	None	--	40-60" over hardpan	Moderate	Impervious in hardpan	Somewhat poor	Medium and high	IIIw	IIIw	Wetness	Drainage; irrigation mgmt; residue mgmt.

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Table 156 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage 3/ of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth
	5	200-950	14-20	200-220	Cropland (fruit orchards)-irrigated (cereals)-dryland	Typic Haploxerolls	Coarse-loamy, mixed, mesic	Chenoweth	70	Terraces (dissected)	Lake sediments	Loam	Loam	None	--	60"+
					Rangeland Forest land	Ultic Haploxeralfs	Fine-loamy, mixed, mesic	Cherryhill	15	Terraces (moderately steep and steep slopes)	Sedimentary rock	Loam	Loam	None	--	20-40" over bedrock
						Ultic Haploxerolls	Coarse-loamy, mixed, mesic	Wind River	2	Terraces (dissected)	Lake sediments	Fine sandy loam	Fine sandy loam	None	--	60"+
						Fluventic Haploxerolls	Coarse-loamy, mixed, mesic		2	Bottomlands	Alluvium	Fine sandy loam	Sandy loam	Gravel	60 below 40-60"	40-60" over gravel
Shallow to deep soils with clayey subsoils on gentle to strong slopes.	6	2,700-4,000	11-13	90-110	Rangeland Cropland (cereals)-dryland (hay and pasture)-irrigated	Calcic Pachic Argixerolls	Fine, montmorillonitic, mesic	Tub	25	Uplands (rolling)	Lake sediments	Gravelly clay loam	Gravelly silty clay	Gravel	20-35 in profile	20-40" over clayey material
						Aridic Calcic Argixerolls	Fine, montmorillonitic, mesic	Simas	25	Uplands (rolling steep and very steep)	Lake sediments	Clay loam	Clay	Stones and Cobbles	5-20% 0-12"; 10-35 10-40"	20-40" over clayey material
						Xerollic Haplargids	Fine, montmorillonitic, mesic	Sorefoot	15	Uplands	Lake sediments	Loam	Clay	None	--	20-40" over clayey materia
						Typic Durixerolls	Clayey-skeletal, montmorillonitic, mesic	Grizzly	10	Uplands (plains)	Water-laid material	Cobbly clay loam	Very stony clay	Stones and Cobbles	20-35 in top 10"; 35-80 below 10" in profile	20-40" over hardpan
						Calciorthidic Haploxerolls	Fine-loamy, mixed, mesic	Currant	10	Uplands (north exposures)	Lake sediment & basic igneous rock	Silt loam	Silty clay loam	Gravel	35-80 below 20-40"	20-40" over gravelly colluvium
						Aridic Cumulic Haploxerolls	Coarse-silty, mixed, mesic	Powder	5	Bottomlands	Alluvium	Loam	Silt loam	Gravel	60 below 40-60"	40-60" over gravel

Table 156 - Continued

...tion on ...ndscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass 6/: Dryland	Range of: Major Capability Subclass 6/: Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
	Soil Characteritistics								Soil Qualities and Interpretations					
...erraces (dissected)	Lake sediments	Loam	Loam	None	--	60"+	Moderate	Moderate	Good	High	IIe IIIe IVe	IIe IIIe IVe	Erosion	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt.
...erraces (moderately steep and steep slopes)	Sedimentary rock	Loam	Loam	None	--	20-40" over bedrock	Moderate	Impervious	Good	Low and medium	IIe IIIe IVe VIe	IIe IIIe IVe	Erosion; moderately deep over bedrock	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt; rangeland mgmt.
...erraces (dissected)	Lake sediments	Fine sandy loam	Fine sandy loam	None	--	60"+	Moderately rapid	Moderately rapid	Somewhat excessive	Medium	IIIs IVs	IIIs IVs	Erosion; sandy profile	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt.
...ottomlands	Alluvium	Fine sandy loam	Sandy loam	Gravel	60 below 40-60"	40-60" over gravel	Rapid	Very rapid	Somewhat poor	Low and medium	IIIs	IIIs	Wetness; sandy profile	Drainage; residue mgmt; cropping sequence; irrigation management
...plands (rolling)	Lake sediments	Gravelly clay loam	Gravelly silty clay	Gravel	20-35 in profile	20-40" over clayey material	Slow	Slow	Good	Medium	IIIe IVe VIe	IIIe	Erosion; gravelly and clayey profile	Rangeland mgmt; cross-slope opers; residue mgmt; cropping sequence; irrigation management
Uplands (rolling steep and very steep)	Lake sediments	Clay loam	Clay	Stones and Cobbles	5-20% 0-12"; 10-35 10-40"	20-40" over clayey material	Slow	Slow	Good	Medium and High	VIe VIIe	--	Erosion; clayey profile	Rangeland management
Uplands	Lake sediments	Loam	Clay	None	--	20-40" over clayey material	Slow	Slow	Good	Medium and high	VIe	--	Erosion; clayey profile	Rangeland management
Uplands (plains)	Water-laid material	Cobbly clay loam	Very stony clay	Stones and Cobbles	20-35 in top 10"; 35-80 below 10" in profile	20-40" over hardpan	Slow	Impervious in hardpan	Good	Low	VIe	--	Erosion; moderately deep over hardpan; cobbly and stony profile	Rangeland management
Uplands (north exposures)	Lake sediment & basic igneous rock	Silt loam	Silty clay loam	Gravel	35-80 below 20-40"	20-40" over gravelly colluvium	Moderately slow	Moderate to rapid	Good	Medium	VIe VIIe	--	Erosion; moderately deep over gravelly colluvium	Rangeland management
Bottomlands	Alluvium	Loam	Silt loam	Gravel	60 below 40-60"	40-60" over gravel	Moderate	Very rapid	Good	Medium and high	IIc IIIe	IIc IIIe	Erosion; droughtiness	Residue mgmt; cropping sequence; irrigation management

Table 156 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage 3/ of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth	Perme[...] Sub[...]
Shallow to moderately deep, frigid soils with clayey subsoils on nearly level to moderate slopes.	7	3,800-4,400	15-20	30-60	Rangeland	Typic Argixerolls	Clayey, montmorillonitic, frigid, shallow	Fopiano	70	Uplands	Lake sediments	Clay loam	Clay	None	--	12-20" over 50% volcanic tuff	Slow
					Cropland (hay and cereals)-80% irrigated	Cumulic Cryaquolls	Fine-silty, mixed, non-calcareous	Damon	5	Bottomlands	Alluvium	Silt loam	Silty clay loam	None	--	20-30" over water table	Modera[...] slow
						Cumulic Cryaquolls	Fine, montmorillonitic, non-calcareous	Silvies	5	Bottomlands	Alluvium	Silty clay loam	Clay	None	--	20-30" over water table	Slow
Shallow and very deep soils with silty profiles on gentle to steep slopes.	8	300-2,500	9-16	130-180	Cropland (cereals, pasture, and hay)-1% irrigated	Typic Haploxerolls	Coarse-silty, mixed, mesic	Walla Walla	50	Uplands	Loess	Silt loam	Silt loam	None	--	60"+	Modera[...]
					Rangeland	Lithic Xerollic Camborthids	Loamy, mixed, mesic	Starbuck	15	Uplands (steep south slopes)	Loess & basic igneous rock	Stony silt loam	Stony silt loam	Cobbles and stones	20-35 in profile	10-20" over bedrock	Modera[...]
						Aridic Duixerolls	Coarse-silty, mixed, mesic	Pilot Rock	10	Uplands (ridgetops)	Loess & basic igneous rock	Silt loam	Silt loam	None	--	20-40" over bedrock	Modera[...]
						Calcic Haploxerolls	Coarse-loamy, mixed, mesic	Dufur	5	Uplands (ridgetops & side slopes)	Loess & sedimentary rock	Silt loam	Silt loam	None	--	20-40" over bedrock	Modera[...]
						Calcic Haploxerolls	Fine-loamy, mixed, mesic	Asotin	3	Uplands (plateau tops & side slopes)	Loess over basic igneous rock	Silt loam	Silt loam	Gravel and Cobbles	0-20 in profile	20-40" over bedrock	Modera[...]
						Cumulic Haploxerolls	Coarse-silty, mixed, mesic	Hermiston	2	Bottomlands	Alluvium	Loam	Very fine sandy loam	None	--	60"+	Modera[...]

Table 156 - Continued

...ition							Soil Characteristics	Soil Qualities and Interpretations						
				Coarse Fragments						Total Available Water-holding	Range of: Major Capability Subclass			
...dscape	Parent Material	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Capacity	Dryland	Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
...ands	Lake sediments	Clay loam	Clay	None	--	12-20" over 50% volcanic tuff	Slow	Slow	Good	Medium	VIe	--	Erosion; clayey profile; shallow	Rangeland management
...tomlands	Alluvium	Silt loam	Silty clay loam	None	--	20-30" over water table	Moderately slow	Moderately slow to impervious	Poor	High	Vw	Vw	High water table	Drainage; irrigation management; pastureland management
...tomlands	Alluvium	Silty clay loam	Clay	None	--	20-30" over water table	Slow	Slow to impervious	Poor	High	Vw	Vw	High water table; clayey profile	Drainage; irrigation management; pastureland management
...ands	Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IIc IIIe IVe VIe	--	Erosion	Cross-slope operations; cropping sequence; residue mgmt; terrace diversions; pastureland mgmt; rangeland management
...ands ...eep ...th ...pes)	Loess & basic igneous rock	Stony silt loam	Stony silt loam	Cobbles and stones	20-35 in profile	10-20" over bedrock	Moderate	Impervious	Good and somewhat excessive	Low	VIe VIIs	--	Shallow over bedrock; stony profile	Rangeland management
...ands ...dge- ...ps)	Loess & basic igneous rock	Silt loam	Silt loam	None	--	20-40" over bedrock	Moderate	Impervious	Good	Low and medium	IIIe IVe VIe	IIIe	Erosion; moderately deep over bedrock	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt; rangeland mgmt.
...ands ...dgetops ...ide ...pes)	Loess & sedimentary rock	Silt loam	Silt loam	None	--	20-40" over bedrock	Moderate	Impervious	Good	Low and medium	IIc,IIIe IIIs IVe VIe	IIc IIIe IIIs	Erosion; moderately deep over bedrock	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt; rangeland mgmt.
...ands ...lateau ...s & side ...pes)	Loess over basic igneous rock	Silt loam	Silt loam	Gravel and Cobbles	0-20 in profile	20-40" over bedrock	Moderate	Impervious	Good	Low and medium	IIIs IVe VIe VIIe	--	Erosion; moderately deep over bedrock; strongly alkaline & calcareous below 20"	Cross-slope operations; residue mgmt; cropping sequence; pastureland mgmt; rangeland mgmt.
...tomlands	Alluvium	Loam	Very fine sandy loam	None	--	60"+	Moderate	Moderate	Good	High	IIc IIIs IIIc	I,IIc, IIIs IIIc	Droughtiness; calcareous & strongly alkaline below 24"	Irrigation management; residue mgmt; cropping sequence

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COLUMBIA-NORTH PACIFIC REGION COMPREHENSIVE FRAMEWORK STUDY OF --ETC(U)
JUN 70 C C BOWLSBY, R J COFFMAN, C R HUBBARD

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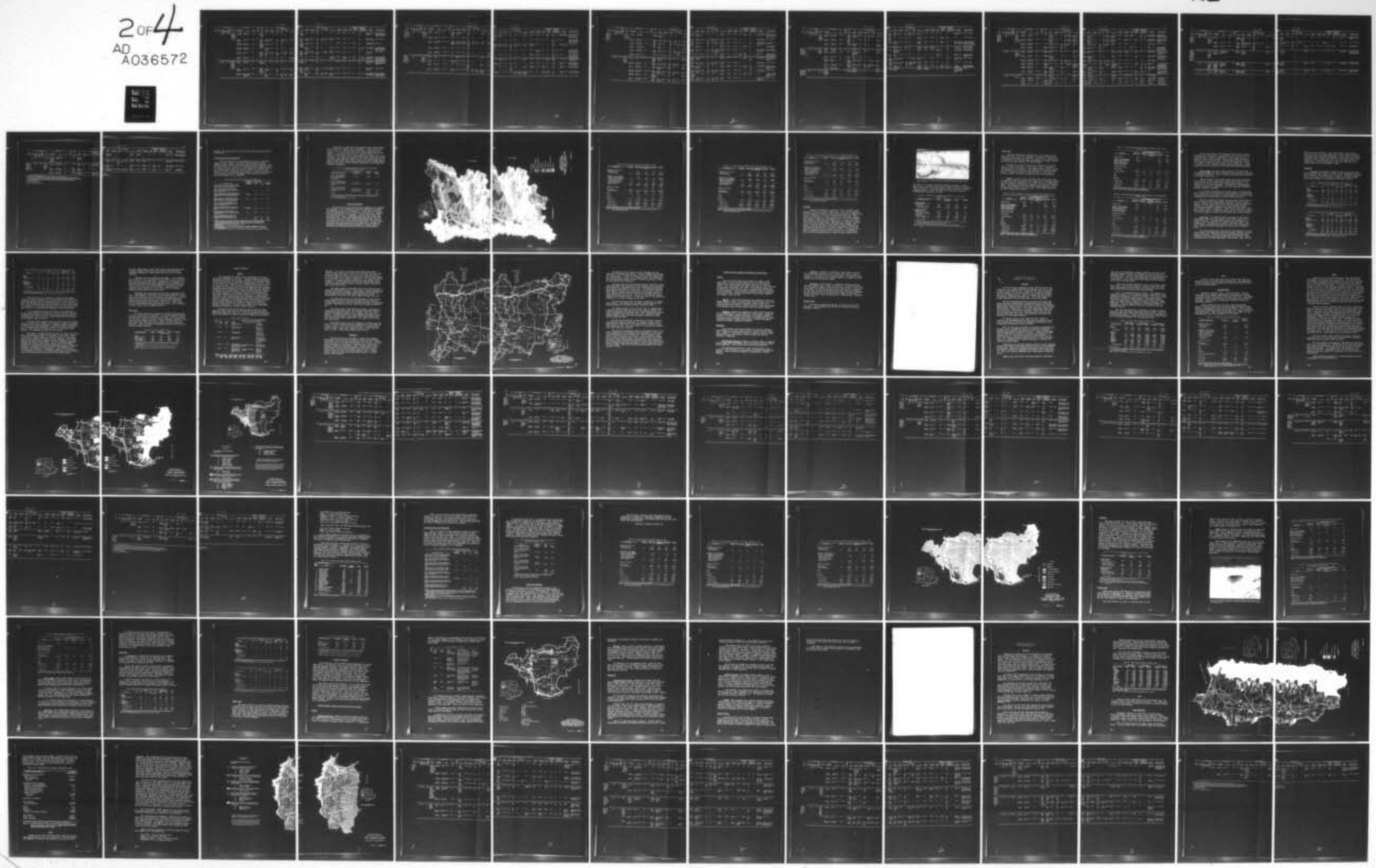

Table 156 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Soil Characteristics: Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Dep
	9	1,000-1,100	9-12	140-180	Cropland (cereals)-dryland (limited hay & pasture)-irrigated	Calciorthidic Haploxerolls	Coarse-silty, mixed, mesic	Ritzville	40	Uplands (nearly level to rolling)	Loess	Silt loam	Silt loam	None	--	60"+
					Rangeland	Lithic Xerollic Camborthids	Loamy, mixed, mesic	Starbuck	15	Uplands (steep south slopes)	Loess and basic igneous rock	Stony silt loam	Stony silt loam	Cobbles and stones	20-35 in profile	10-20" over bedrock
						Calciorthidic Haploxerolls	Coarse-silty, mixed, mesic	Ritzcal	10	Uplands (plateau edges & upper side slopes)	Loess (calcareous)	Silt loam	Silt loam	None	--	60"+
						Calciorthidic Haploxerolls	Coarse-loamy, mixed, mesic	Farrell	10	Terraces	Loess and glacial material	Silt loam	Sandy loam	None	--	40-60" over sand
						Calcic Lithic Haploxerolls	Loamy, mixed, mesic	Kuhl	10	Uplands (slopes along drainage ways)	Loess and basic igneous rock	Gravelly silt loam	Very gravelly silt loam	Gravel	35-80 in profile	10-20" over bedrock
						Orthidic Durixerolls	Coarse-silty, mixed, mesic	Willis	5	Uplands	Loess	Silt loam	Silt loam	None	--	20-40" over lime hardpa
	10	500-1,000	7-9	150-200	Cropland (cereals) dryland (cereals, hay and pasture)-irrigated	Xerollic Camborthids	Coarse-silty, mixed, mesic	Shano	70	Uplands (plateaus & rolling hills)	Loess	Silt loam	Silt loam	None	--	60"+
					Rangeland	Lithic Xerollic Camborthids	Loamy, mixed, mesic	Starbuck	10	Uplands (south exposures along drainageways)	Loess and basic igneous rock	Silt loam	Very gravelly silt loam	Gravel	35-80 below 10"	10-20" over bedrock
						Calciorthidic Haploxerolls	Coarse-loamy over sandy or sandy-skeletal mixed, mesic	Magalion	10	Terraces	Alluvium over glacial outwash	Loam	Sandy loam	Gravel and sand	60 below 20-40"	20-40" over sand and gravel

Table 156 - Continued

...ent ...e[3] of ...sn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass[6]: Dryland	Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
10	Uplands (nearly level to rolling)	Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IIIe IVe VIe	I	Erosion; free lime below 30"; droughtiness	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt; rangeland management
15	Uplands (steep south slopes)	Loess and basic igneous rock	Stony silt loam	Stony silt loam	Cobbles and stones	20-35 in profile	10-20" over bedrock	Moderate	Impervious	Good	Low	VIe VIIs	--	Shallow over bedrock; stony profile	Rangeland management
10	Uplands (plateau edges & upper side slopes)	Loess (calcareous)	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	Medium	IVe VIe	--	Erosion; strongly calcareous below 10"	Permanent cover
10	Terraces	Loess and glacial material	Silt loam	Sandy loam	None	--	40-60" over sand	Rapid	Very rapid	Good	Medium	IIIe IVe VIe	IIe IIIe IVe	Erosion; sandy profile; droughtiness	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt; rangeland management
0	Uplands (slopes along drainage ways)	Loess and basic igneous rock	Gravelly silt loam	Very gravelly silt loam	Gravel	35-80 in profile	10-20" over bedrock	Moderate	Impervious	Good	Low	VIs VIIs	--	Shallow over bedrock; gravelly profile	Rangeland management
5	Uplands	Loess	Silt loam	Silt loam	None	--	20-40" over lime hardpan	Moderate	Impervious in hardpan	Good	Low and high	IIIs IVe VIe	IIIs IIIe IVs IVe	Erosion; moderately deep over hardpan; droughtiness	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt; rangeland management
0	Uplands (plateaus & rolling hills)	Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IVe VIe VIIe	IVe	Erosion; strongly alkaline below 30"; droughtiness	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt; rangeland mgmt.
[illegible]	Uplands (south exposures along drainageways)	Loess and basic igneous rock	Silt loam	Very gravelly silt loam	Gravel	35-80 below 10"	10-20" over bedrock	Moderate	Impervious	Good	Low	VIIs	--	Shallow over bedrock; gravelly profile	Rangeland management
0	Terraces	Alluvium over glacial outwash	Loam	Sandy loam	Gravel and sand	60 below 20-40"	20-40" over sand and gravel	Moderate	Very rapid	Good	Low	IVe VIe	IVe IVs	Erosion; moderately deep over gravel and sand; droughtiness	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt; rangeland management

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Table 156 - Continued

Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth	Perme S
		Soil Association				Classification					Soil Characteristics						
Shallow to very deep soils with silty profiles and cold winters on gentle to steep slopes.	11	1,500-3,000	16-20	140-160	Cropland (cereals, peas, hay & grass)-15% irrigated	Pachic Argixerolls	Fine-loamy, mixed, mesic	Waha	30	Uplands (plateau tops and side slopes)	Loess and basic igneous rock	Silt loam	Silty clay loam	None	--	20-40" over bedrock	Moder slow
					Rangeland	Typic Haploxerolls	Fine-silty, mixed, mesic	Athena	25	Uplands	Loess	Silt loam	Silt loam	None	--	60"+	Moder
						Lithic Argixerolls	Loamy-skeletal, mixed, mesic	Rock Creek	20	Uplands (ridgetops & south slopes)	Loess and basic igneous rock	Stony loam to stony silty clay loam	Stony loam to stony silty clay loam	Cobbles and stones	20-35 in profile	10-20" over bedrock	Moder moder slow
						Typic Haploxerolls	Fine-silty, mixed, mesic	Palouse	15	Uplands	Loess	Silt loam	Silt loam	None	--	60"+	Moder
						Ultic Palexerolls	Fine-loamy, mixed, mesic	Goldendale	10	Terraces	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Modera slow
Very deep and deep soils with loamy subsoils and mild winters on gentle to very steep slopes.	12	400-1,000	30-45	150-165	Forest land[4] Cropland (fruit orchards, pasture & hay)-1% irrigated	Xeric Haplohumults	Clayey, mixed, mesic	Olympic	40	Uplands	Basic igneous rock	Clay loam	Clay loam	None	--	60"+ over bedrock	Modera
						Typic Vitrandepts	Ashy, mesic	Chemawa	25	Terraces & footslopes	Volcanic ash	Shotty loam	Shotty loam	None	--	60"+	Modera
						Typic Argiudolls	Fine, mixed, mesic	St. Martins	5	Basins	Alluvium	Clay loam	Silty clay loam or silty clay	None	--	60"+ over bedrock	Modera slow o
						Ultic Haploxerolls	Coarse-loamy, mixed, mesic	Wind River	5	Terraces & footslopes	Alluvium	Gravelly loam	Gravelly loam	Gravel and sand	20-35 in profile; 60 below 40-50"	40-50" over gravelly and sandy material	Modera

Table 156 - Continued

Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
Uplands (plateau tops and side slopes)	Loess and basic igneous rock	Silt loam	Silty clay loam	None	--	20-40" over bedrock	Moderately slow	Impervious	Good	Low and medium	IIIe IVe VIe	IIIe	Erosion; moderately deep over bedrock	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt; rangeland mgmt.
Uplands	Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IIe IIIe IVe VIe	IIe IIIe	Erosion	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt; rangeland mgmt.
Uplands (ridgetops & south slopes)	Loess and basic igneous rock	Stony loam to stony silty clay loam	Stony loam to stony silty clay loam	Cobbles and stones	20-35 in profile	10-20" over bedrock	Moderate and moderately slow	Impervious	Good	Low	VIe,VIs VIIe VIIs	--	Shallow over bedrock; stony profile	Rangeland management
Uplands	Loess	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate and moderately slow	Good	High	IIe,IIIe IVe VIe	IIe IIIe	Erosion	Cross-slope operations residue mgmt; cropping sequence; irrigation mgmt; rangeland mgmt.
Terraces	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderately slow	Moderately slow	Good	High	IIe,IIIe IVe VIe VIIe	IIe IIIe	Erosion	Cross-slope operations; residue mgmt; cropping sequence; irrigation mgmt; rangeland mgmt.
Uplands	Basic igneous rock	Clay loam	Clay loam	None	--	60"+ over bedrock	Moderate	Impervious	Good	Medium and high	IIIe IVe,VIe VIIe	--	Erosion; acid soil	Forest land management; pastureland management; soil amendments
Terraces & footslopes	Volcanic ash	Shotty loam	Shotty loam	None	--	60"+	Moderate	Moderate	Good	High	IIe,IIIe IVe VIe	--	Erosion; ashy profile	Forest land management; pastureland management; residue management
Basins	Alluvium	Clay loam	Silty clay loam or silty clay	None	--	60"+ over bedrock	Moderately slow or slow	Impervious	Somewhat poor	High	IVe VIe,VIIe	--	Erosion; clayey subsoil	Forest land management; pastureland management
Terraces & footslopes	Alluvium	Gravelly loam	Gravelly loam	Gravel and sand	20-35 in profile; 60 below 40-50"	40-50" over gravelly and sandy material	Moderate	Rapid	Good to excessive	Low and medium	IVs VIe VIIe	--	Erosion; gravelly profile	Forest land management; pastureland management

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Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage 3/ of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile
Shallow to deep soils with stony, gravelly, loamy subsoils on gentle to very steep slopes.	13	1,000-3,600	14-20	100-130	Rangeland Cropland (cereals)-3% irrigated	Typic Vitrandepts	Ashy over loamy, mixed, mesic		30	Uplands (ridgetops)	Loess over basic igneous rock	Loam	Loam	None	--	20-40" ov bedrock
					Forest land 4/	Lithic Haploxerolls	Loamy-skeletal, mixed, mesic	Skyline	25	Uplands (south slopes)	Sedimentary rock	Very stony loam	Very stony loam	Stones and cobbles	35-80 in profile	10-20" ove bedrock
						Typic Xerochrepts	Coarse-loamy, mixed, mesic	Frailey	15	Uplands (north slopes)	Sedimentary rock	Loam	Gravelly loam	Gravel	20-35 below 10" in profile	20-40" ove bedrock
						Andic Haplumbrepts	Fine-loamy, mixed, mesic, (frigid)		10	Uplands	Basic igneous rock	Loam	Silt loam	None	--	40-60" ove bedrock
						Typic Haploxerolls	Loamy-skeletal, mixed, mesic	Bald	5	Uplands (south slopes)	Basic igneous rock	Stony loam	Very stony loam	Stones and cobbles	20-35 in top 10"; 35-80 below 10" in profile	20-40" ove bedrock
						Fluventic Haploxerolls	Coarse-loamy, mixed, mesic		2	Bottomlands	Alluvium	Fine sandy loam	Sandy loam	Gravel	60 below 40-60"	40-60" over gravel
	14	700-3,100	10-16	130-160	Rangeland Cropland (cereals, hay & pasture)-1% irrigated	Typic Haploxerolls	Fine-silty, mixed, mesic	Condon	25	Uplands (gently sloping plateau tops)	Loess over basic igneous rock	Silt loam	Silt loam	None	--	20-40" over bedrock
						Aridic Lithic Haploxerolls	Loamy-skeletal, mixed, mesic	Bakeoven	20	Uplands (plateau tops)	Basic igneous rock	Very stony loam	Very stony loam	Stones and Cobbles	35-80 in profile	5-10" over bedrock
						Calcic Argixerolls	Fine-silty, mixed, mesic	Morrow	20	Uplands (ridgetops)	Loess over basic igneous rock	Silt loam	Silty clay loam	None	--	20-40" over bedrock
						Aridic Lithic Haploxerolls	Loamy-skeletal, mixed, mesic	Lickskillet	10	Uplands (steep south slopes)	Loess & basic igneous rock	Very stony loam	Very stony loam	Stones and Cobbles	35-80 in profile	10-20" over bedrock
						Calciorthidic Haploxerolls	Fine-silty, mixed, mesic	Bickleton	5	Uplands (gently to moderately sloping)	Loess	Silt loam	Silt loam	None	--	40-60" over bedrock
						Typic Haploxerolls	Loamy-skeletal, mixed, mesic	Wrentham	5	Uplands (north slopes)	Loess & basic igneous rock	Stony silt loam	Very stony loam	Stones and cobbles	35-80 in profile	20-40" over bedrock

Table 156 - Continued

Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Range of: Major Capability Subclass: Irrigated[6]	Major Soil Problems	Suitable Land Treatment and Structures
Soil Characteristics							Soil Qualities and Interpretations							
Uplands (ridgetops)	Loess over basic igneous rock	Loam	Loam	None	--	20-40" over bedrock	Moderate	Impervious	Good	Low and medium	IIIe IVe VIe	IIIe	Erosion; moderately deep over bedrock	Rangeland mgmt; cross-slope operations; residue mgmt; cropping sequence; irrigation management
Uplands (south slopes)	Sedimentary rock	Very stony loam	Very stony loam	Stones and cobbles	35-80 in profile	10-20" over bedrock	Moderate	Impervious	Good	Low	VIIs	--	Shallow over bedrock; stony profile	Rangeland management
Uplands (north slopes)	Sedimentary rock	Loam	Gravelly loam	Gravel	20-35 below 10" in profile	20-40" over bedrock	Moderate	Impervious	Good	Low	VIe VIIe	--	Erosion; moderately deep over bedrock; gravelly subsoil	Forest land and rangeland management
Uplands	Basic igneous rock	Loam	Silt loam	None	--	40-60" over bedrock	Moderate	Impervious	Good	Medium and high	VIe VIIe	--	Erosion	Forest land management; rangeland management
Uplands (south slopes)	Basic igneous rock	Stony loam	Very stony loam	Stones and cobbles	20-35 in top 10"; 35-80 below 10" in profile	20-40" over bedrock	Moderate	Impervious	Good	Low	VIIs	--	Erosion; moderately deep over bedrock; stony profile	Rangeland management; forest land management
Bottomlands	Alluvium	Fine sandy loam	Sandy loam	Gravel	60 below 40-60"	40-60" over gravel	Rapid	Very rapid	Somewhat poor	Low and medium	IIIs	IIIs	Wetness; sandy profile	Drainage; residue mgmt; cropping sequence; irrigation management
Uplands (gently sloping plateau tops)	Loess over basic igneous rock	Silt loam	Silt loam	None	--	20-40" over bedrock	Moderate	Impervious	Good	Low and medium	IIc IIIe IIIs IVe	--	Erosion; moderately deep over bedrock	Cross-slope operations; residue mgmt; cropping sequence; pastureland management
Uplands (plateau tops)	Basic igneous rock	Very stony loam	Very stony loam	Stones and Cobbles	35-80 in profile	5-10" over bedrock	Moderate	Impervious	Good	Low	VIIs	--	Shallow over bedrock; stony profile	Rangeland management
Uplands (ridgetops)	Loess over basic igneous rock	Silt loam	Silty clay loam	None	--	20-40" over bedrock	Moderately slow	Impervious	Good	Low and medium	IIIe IIIs IVe VIe	--	Erosion; moderately deep over bedrock	Cross-slope operations; residue mgmt; cropping sequence; rangeland management.
Uplands (steep south slopes)	Loess & basic igneous rock	Very stony loam	Very stony loam	Stones and Cobbles	35-80 in profile	10-20" over bedrock	Moderate	Impervious	Good	Low	VIIs	--	Shallow over bedrock; stony profile	Rangeland management
Uplands (gently to moderately sloping)	Loess	Silt loam	Silt loam	None	--	40-60" over bedrock	Moderate	Impervious	Good	Medium and high	IIIe IVe	--	Erosion	Cross-slope operations; residue mgmt; cropping sequence; pastureland management
Uplands (north slopes)	Loess & basic igneous rock	Stony silt loam	Very stony loam	Stones and cobbles	35-80 in profile	20-40" over bedrock	Moderate	Impervious	Good	Low	VIIs	--	Moderately deep over bedrock; rocky and stony profile	Rangeland management

2

Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth	
	Soil Association					**Classification**					**Soil Characteristics**						
	15	200-3,100	10-14	130-200	Rangeland Cropland (cereals, hay & pasture)-50% irrigated	Aridic Lithic Haploxerolls	Loamy-skeletal, mixed, mesic	Lickskillet	40	Uplands (steep south slopes)	Loess and basic igneous rock	Very stony loam	Very stony loam	Stones and cobbles	35-80 in profile	10-20" over bedrock	M
						Pachic Haploxerolls	Coarse-silty, mixed, mesic	Nansene	30	Uplands (steep north slopes)	Loess	Silt loam	Silt loam	None	--	40-60"+ over bedrock	M
						Xerollic Camborthids	Coarse-silty, mixed, mesic	Sagemoor	5	Terraces (dissected)	Loess over lacustrine material	Silt loam	Silt loam	None	--	20-40" over compact sediments	M
Shallow to very deep soils with clayey and loamy subsoils and cold winters on gentle to very steep slopes.	16	4,000-4,500	8-12	Less than 90	Rangeland Cropland (pasture and hay)-dryland	Xerollic Durargids	Fine-loamy, mixed, mesic	Hager	30	Terraces	Water-laid material	Loam	Clay loam	None	--	15-24" over hardpan	Mo s
						Xerollic Camborthids	Coarse-loamy, mixed, mesic	Deschutes	30	Terraces	Pumice and water-laid material over basic igneous rock	Sandy loam	Loam	None	--	15-30" over bedrock	Mo
						Typic Palexeralfs	Fine, mixed, mesic	Swartz	10	Lake bottoms	Lake sediments	Silt loam	Clay	None	--	60"+	Si
						Lithic Xerollic Haplargids	Clayey, mixed, frigid	Hart	10	Uplands (gently sloping plateaus)	Basic igneous rock	Very stony loam	Clay	Stones	35-80 in top 10"	10-20" over bedrock	Si
						Xerollic Haplargids	Loamy-skeletal, mixed, frigid	Plush	10	Uplands (fault escarpments)	Basic igneous rock	Very stony loam	Very stony loam	Stones, cobbles & gravel	35-80 in profile	40-70" over bedrock	Mo
						Haplorthents	Fine-loamy, mixed, mesic and frigid		5	Uplands	Basic igneous rock	Loam	Loam	None	--	36-60" over bedrock	Mo
Shallow, rocky miscellaneous land with very cold soils on strong to extremely steep slopes.	17	6,000-8,400	30-45	None	Other land Forest land[4/]	Cryumbrepts plus Cryorthods, Haplorthods, and Rockland	--	--	100	Uplands (steep mtns)	Igneous rock & volcanic ash	--	--	--	--	0-60"+ over bedrock	Mo imp

Table 156 - Continued

ition on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
Uplands (steep south slopes)	Loess and basic igneous rock	Very stony loam	Very stony loam	Stones and cobbles	35-80 in profile	10-20" over bedrock	Moderate	Impervious	Good	Low	VIIs	--	Shallow over bedrock; stony profile	Rangeland management
Uplands (steep north slopes)	Loess	Silt loam	Silt loam	None	--	40-60"+ over bedrock	Moderate	Impervious	Good	Medium and high	VIIe VIIs	--	Erosion	Rangeland management
Terraces (dissected)	Loess over lacustrine material	Silt loam	Silt loam	None	--	20-40" over compact sediments	Moderate	Very slow	Good	Medium and high	IVe VIe	IVe	Erosion; strongly alkaline lacustrine material below 20-40"	Irrigation mgmt; cropping sequence; cross-slope opers; residue mgmt; rangeland mgmt; pastureland mgmt
Terraces	Water-laid material	Loam	Clay loam	None	--	15-24" over hardpan	Moderately slow	Impervious in hardpan	Good	Low	IVe VIe	--	Erosion; shallow over hardpan	Rangeland management pastureland management
Terraces	Pumice and water-laid material over basic igneous rock	Sandy loam	Loam	None	--	15-30" over bedrock	Moderate	Impervious	Somewhat excessive	Low	IVe VIe	--	Erosion; moderately deep over bedrock	Rangeland management; pastureland management
Lake bottoms	Lake sediments	Silt loam	Clay	None	--	60"+	Slow	Slow	Somewhat poor	High	IVs	--	Wetness; clayey profile	Rangeland management; pastureland management drainage
Uplands (gently sloping plateaus)	Basic igneous rock	Very stony loam	Clay	Stones	35-80 in top 10"	10-20" over bedrock	Slow	Impervious	Good	Low	VIe, VIIe VIIs	--	Shallow over bedrock; stony surface soil	Rangeland management
Uplands (fault escarpments)	Basic igneous rock	Very stony loam	Very stony loam	Stones, cobbles & gravel	35-80 in profile	40-70" over bedrock	Moderate	Impervious	Good	Low	VIIs	--	Stony profile	Rangeland management
Uplands	Basic igneous rock	Loam	Loam	None	--	36-60" over bedrock	Moderate	Impervious	Good	Medium and high	IIIe, IVe VIe	--	Erosion; droughtiness	Rangeland management; pastureland management
Uplands (steep mtns)	Igneous rock & volcanic ash	--	--	--	--	0-60"+ over bedrock	Moderate to impervious	--	Good	Low	VIIIs	--	Shallow over bedrock; steep slopes; cold climate; high elevations; steep slopes	Protection

2

Table 156 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position of Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth
Shallow to moderately deep soils with loamy and rocky subsoils on gentle to very steep slopes.	18	2,500-3,500	9-12	100-120	Rangeland Cropland (pasture, hay and potatoes)-60% irrigated Forest land[4]	Xerollic Camborthids	Coarse-loamy, *mixed, mesic*	Deschutes	60	Terraces	Water-laid *material* & basic igneous rock	Sandy loam	Loam	Gravel and sand	60 below 15-30" in some places	15-30" over bedrock or gravel and sand
						Xerollic Camborthids	Fine-loamy, mixed, mesic	Redmond	15	Terraces	Water-laid material & basic igneous rock	Sandy loam	Loam	Gravel and sand	60 below 30-40" in some places	30-40" over bedrock or gravel and sand
						Aridic Lithic Haploxerolls	Loamy-skeletal, mixed, mesic	Bakeoven	15	Terraces	Basic igneous rock	Very stony loam	Very stony loam	Stones and cobbles	35-80 in profile	5-10" over bedrock
						Aquic Haploxeralfs	Fine-loamy, mixed, mesic	Odin	5	Terraces (depressions)	Water-laid material	Clay loam	Silty clay loam	None	--	60"+
	19	2,000-3,000	9-16	90-120	Rangeland Cropland (grass seed, mint & potatoes)-irrigated	Xerollic Durargids	Fine-loamy, mixed, mesic	Madras	30	Uplands (plateaus)	Water-laid material	Loam	Clay loam	None	--	20-40" over hardpan
						Xerollic Haplargids	Fine-loamy, mixed, mesic	Agency	25	Uplands (plateaus)	Water-laid material over basic igneous rock	Loam	Silt loam	None	--	20-40" over bedrock
						Aridic Lithic Haploxerolls	Loamy-skeletal, mixed, mesic	Bakeoven	20	Uplands (plateaus)	Basic igneous rock	Very stony loam	Very stony loam	Stones and cobbles	35-80 in profile	5-10" over bedrock
						Xerollic Camborthids	Coarse-loamy, mixed, mesic	Metolius	10	Basins, bottomlands, and fans	Alluvium	Sandy loam	Sandy loam	Gravel	60 below 40-60" in places	40-60" over loamy sand or gravelly sandy material
						Calciorthidic Haploxerolls	Coarse-loamy, mixed, mesic	Era	5	Uplands (plains)	Water-laid material over basic igneous rock	Sandy loam	Sandy loam to loam	None	--	20-40" over bedrock
						Typic *Argixerolls*	Fine-loamy, mixed, mesic	Wapanitia	5	Uplands (nearly level)	Loess over basic igneous rock	Silt loam	Silty clay loam	None	--	40-60" over bedrock
	20	2,500-4,500	17-35	80-120	Forest land[4] Rangeland	--	--	Rockland[5]	40	Uplands	Basic igneous rock	--	--	--	--	0-10" over bedrock
						Typic Haploxeralfs	Coarse-loamy, mixed, mesic	Underwood	20	Uplands	Loess & basic igneous rock	Silt loam	Clay loam	None	--	20-40" over basalt
						Typic Vitrandepts	Cindery, mesic	Guler	10	Footslopes & terraces	Loess and pumice	Loam	Loam	None	--	60"+
						Typic Vitrandepts	Ashy, mesic	Chemawa	10	Terraces & footslopes	Volcanic ash	Sandy loam	Loam	None	--	60"+

Table 156 - Continued

...on	Soil Characteristics						Soil Qualities and Interpretations							
				Coarse Fragments						Total Available Water-holding Capacity	Range of: Major Capability Subclass 6/			
...ape	Parent Material	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class		Dryland	Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
...es	Water-laid material & basic igneous rock	Sandy loam	Loam	Gravel and sand	60 below 15-30" in some places	15-30" over bedrock or gravel and sand	Moderate	Impervious to very rapid	Somewhat excessive	Low	IIs,IIIe IIIs IVe VIe	IIs IIIe IIIs IVe	Erosion; moderately deep over bedrock or gravel and sand	Rangeland management; cross-slope opers; residue mgmt; cropping sequence;irrigation mgmt.
...tes	Water-laid material & basic igneous rock	Sandy loam	Loam	Gravel and sand	60 below 30-40" in some places	30-40" over bedrock or gravel and sand	Moderate	Impervious to very rapid	Good	Low and medium	IIs IIIe	IIs IIIe	Erosion; moderately deep over bedrock or gravel and sand	Cross-slope operations; residue mgmt; cropping sequence; irrigation management
...ces	Basic igneous rock	Very stony loam	Very stony loam	Stones and cobbles	35-80 in profile	5-10" over bedrock	Moderate	Impervious	Good	Low	VIIs	--	Shallow over bedrock; stony profile	Rangeland management
...ces (...essions)	Water-laid material	Clay loam	Silty clay loam	None	--	60"+	Slow	Slow	Somewhat poor	High	IVw	IVw	Wetness; clayey profile	Drainage; pastureland mgmt; residue mgmt; cropping sequence; irrigation management
...ds (...eaus)	Water-laid material	Loam	Clay loam	None	--	20-40" over hardpan	Moderately slow	Impervious in hardpan	Good	Low and medium	IVe VIe	IVe	Erosion; moderately deep over hardpan	Rangeland mgmt; cross-slope opers; residue mgmt; cropping sequence; irrigation mgmt.
...nds (...teaus)	Water-laid material over basic igneous rock	Loam	Silt loam	None	--	20-40" over bedrock	Moderate	Impervious	Good	Low and medium	IVe	IVe	Erosion; moderately deep over bedrock	Rangeland mgmt; cross-slope opers; residue mgmt; cropping sequence; irrigation mgmt.
...nds (...teaus)	Basic igneous rock	Very stony loam	Very stony loam	Stones and cobbles	35-80 in profile	5-10" over bedrock	Moderate	Impervious	Good	Low	VIIs	--	Shallow over bedrock; stony profile	Rangeland management
...ns, ...omlands, fans	Alluvium	Sandy loam	Sandy loam	Gravel	60 below 40-60" in places	40-60" over loamy sand or gravelly sandy material	Rapid	Very rapid	Good	Low and medium	IIs IIIe IVe	IIs IIIe IVe	Erosion; sandy profile	Cross-slope opers;residue mgmt; cropping sequence; pastureland mgmt; irrigation management
...nds (...ins)	Water-laid material over basic igneous rock	Sandy loam	Sandy loam to loam	None	--	20-40" over bedrock	Rapid to moderate	Impervious	Good	Low	IIs IIIe IVe VIe	IIs IIIe IVe	Erosion; moderately deep over bedrock; sandy profile	Cross-slope operations; residue mgmt; cropping sequence; pastureland mgmt; irrigation mgmt.
...nds (...rly ...l))	Loess over basic igneous rock	Silt loam	Silty clay loam	None	--	40-60" over bedrock	Moderately slow	Impervious	Good	Medium and high	IIc IIIe IVe	IIc IIIe	Erosion	Cross-slope operations; residue mgmt; cropping sequence; irrigation management
...ands	Basic igneous rock	--	--	--	--	0-10" over bedrock	--	Impervious	Good	Low	VIIe	--	Shallow over bedrock; steep slopes	--
...ands	Loess & basic igneous rock	Silt loam	Clay loam	None	--	20-40" over basalt	Moderately slow	Impervious	Good	Low and medium	IVe VIe,VIIe	--	Erosion; moderately deep over bedrock	Forest land mgmt; rangeland management
...tslopes (...erraces)	Loess and pumice	Loam	Loam	None	--	60"+	Moderate	Moderate	Good	High	IIIs,IVs VIe, VIs	--	Erosion; cindery profile	Forest land and rangeland management
...races & ...tslopes	Volcanic ash	Sandy loam	Loam	None	--	60"+	Moderate	Moderate	Good	High	IIe,IIIe IVe, VIe	--	Erosion; ashy profile	Forest land and rangeland management

2

Table 156 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth	Permea Sub
Very deep soils with sandy and loamy subsoils on gentle to very steep slopes.	21	2,000-5,000	60-140	120-170	Forest land[4/] Cropland (hay, pasture, and silage)-some irrigated	Typic Dystrandepts	Ashy, mesic	Cinebar	40	Uplands (rolling & mountaineous)	Volcanic ash over basic igneous rock	Silt loam	Silt loam	None	--	60"+	Modera
						Umbric Vitrandepts	Cindery, mesic	Cispus	30	Terraces & mountain slopes	Pumice, ash, & some basic igneous rock	Gravelly sandy loam	Gravelly loamy sand	Gravel	20-35 in profile	60"+	Rapid
						Xeric Haplohumults	Clayey, mixed, mesic	Olympic	20	Uplands & mountain slopes	Basic igneous rock	Clay loam	Clay loam or silty clay loam	None	--	40-72"+ over bedrock	Modera
Moderately deep to very deep and miscellaneous land with frigid soils and stony and loamy subsoils on gentle to very steep slopes.	22	3,000-7,000	16-45	0-100	Forest land[4/] Rangeland Cropland (cereals, hay & pasture) - dryland	Argixerolls plus Cryandepts and Haploxerolls	Fine-loamy, mixed, frigid and ashy over loamy, fine loamy	--	100	Uplands & side slopes	Volcanic ash, loess & basic igneous rock	--	--	--	--	20-60" over bedrock	Modera
	23	1,100-5,000	30-40	60-100	Forest land[4/] Cropland (limited pasture & fruit orchards) - dryland	Cryorthents plus Cryumbrepts, Cryorthods, Cryandepts, Haplorthods and Rockland	Ashy & cindery over loamy, mixed & coarse loamy, mixed, frigid	--	100	Uplands (mountaineous slopes)	Volcanic ash and basic igneous rock	--	--	--	--	20-60" over bedrock	Moderat
	24	3,500-4,500	15-40	40-100	Forest land[4/] Rangeland	Cryorthents plus Cumborthids	Ashy over loamy & cindery, mixed, frigid	--	100	Uplands, terraces & bottomlands	Pumice & basic igneous rock	--	--	--	--	20-70" over bedrock	Very ra

Table 156 - Continued

				Soil Characteristics						Soil Qualities and Interpretations				
				Coarse Fragments						Total Available Water-holding Capacity	Range of: Major Capability Subclass			
ape	Parent Material	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class		Dryland	Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
is ing & aineous)	Volcanic ash over basic igneous rock	Silt loam	Silt loam	None	--	60"+	Moderate	Impervious	Good	High	IIe, IIIe, IVe VIIe	IIe IIIe	Erosion; ashy profile; acid soil	Forest land mgmt; soil amendments; irrigation management
ces & ain s	Pumice, ash, & some basic igneous rock	Gravelly sandy loam	Gravelly loamy sand	Gravel	20-35 in profile	60"+	Rapid	Rapid	Somewhat excessive	Low	VIs	--	Gravelly profile	Forest land management
ds & ain s	Basic igneous rock	Clay loam	Clay loam or silty clay loam	None	--	40-72"+ over bedrock	Moderate	Impervious	Good	Medium and high	IIIe, IVe VIe, VIIe	--	Erosion; acid soil	Forest land management; soil amendments
ds & s	Volcanic ash, loess & basic igneous rock	--	--	--	--	20-60" over bedrock	Moderate	--	Good	Medium	VIe	--	Erosion with improper land use	Continued forest land mgmt; cross-slope opers; residue mgmt; cropping sequence; range mgmt.
ds tain- slopes)	Volcanic ash and basic igneous rock	--	--	--	--	20-60" over bedrock	Moderate	--	Good	Low to medium	VIe	--	Erosion with improper land use	Continued forest land mgmt and protection
ds, ces & mlands	Pumice & basic igneous rock	--	--	--	--	20-70" over bedrock	Very rapid	--	Excessive	Low to medium	VIe	--	Erosion; gravelly soil	Continued forest land mgmt and rangeland mgmt.

2

Soil Groups	Soil Association: Map Sym.	Soil Association: Elevation Feet	Soil Association: Precip. Inches	Soil Association: Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Classification: Family	Classification: Series 2/	Percentage 3/ of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Soil Characteristics: Texture Surface Soil	Soil Characteristics: Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent
	25 & 26	5,200-7,000	75-100	30-50	Forest land 4/ Other land	Cryandepts plus Cryumbrepts, Cryorthods and Haplumbrepts	Ashy cindery over loamy, mixed, frigid	--	100	Uplands	Pumice, igneous and sedimentary rock	--	--	--	--
Shallow to deep soils with shaley, loamy subsoils and cold winters on moderate to extremely steep slopes.	27	4,200-5,500	13-16	100-165	Rangeland Cropland (hay and pasture)-60% irrigated	Lithic Haploxerolls	Loamy-skeletal, mixed, mesic	Venator	50	Uplands	Sedimentary rock (shale)	Very shaley loam	Very shaley silty clay loam	Cobbles and gravel	35-80 in profile
						Pachic Haploxerolls	Fine-loamy, mixed, frigid	Izee	30	Uplands (north slopes)	Sedimentary rock (shale)	Loam	Loam	None	--
						Cumulic Haploxerolls	Fine-loamy, mixed, frigid	Utley	10	Fans and footslopes	Alluvium and sedimentary rock (shale)	Shaley loam	Shaley loam	Cobbles and gravel	20-35 in profile

1/ Based on data summarized during 1966.
2/ Only soil series names that have a status as reserved, tentative, or established are listed.
3/ Differences of total percentage in each soil association from 100 percent are inclusions of other soils and land types.
4/ *For the upland forest soils, the above characteristics and qualities have been extended from a limited amount of survey data.* Additional data and land use interpretations for forest soils are available in the Forest Land section of Appendix VIII, Land Measures and Watershed Protection. These areas include National Forest and adjacent non-Federal forest lands.
5/ Miscellaneous land types.
6/ Presently irrigated cropland.

SOURCE: National Cooperative Soil Survey.

Table 156 - Continued

on ...dscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass 6/: Dryland	Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
...ands	Pumice, igneous and sedimentary rock	--	--	--	--	0-60" over bedrock	Moderately rapid	--	Good	Low	VIe	--	Shallow over bedrock; erosion	Protection and continued forest land management
...ands	Sedimentary rock (shale)	Very shaley loam	Very shaley silty clay loam	Cobbles and gravel	35-80 in profile	10-20" over bedrock	Moderately slow	Moderately slow	Good	Low	VIIs	--	Shallow over bedrock; shaley profile	Rangeland management
...ands ...rth ...pes)	Sedimentary rock (shale)	Loam	Loam	None	--	20-40" over bedrock	Moderate	Moderately slow	Good	Low and medium	VIe VIIs	--	Erosion; moderately deep over bedrock	Rangeland management
...s and ...tslopes	Alluvium and sedimentary rock (shale)	Shaley loam	Shaley loam	Cobbles and gravel	20-35 in profile	40-60" over bedrock	Moderate	Moderately slow	Good	Low and medium	IIIe	IIIe	Erosion; shaley profile	Pastureland mgmt; irrigation mgmt.

...land types.
...nt of survey data.
...ppendix VIII, Land
...ds.

2

deposits and include many soils with clayey profiles and restricted permeability.

Interpretations and Evaluation

Table 158 relates the land capability classes to the Land Capability Map, figure 3. It must be realized that the Land Capability Map is highly generalized and a specific capability class on table 158 may not be shown. To determine the land capability of any particular area, refer to the soil association symbols listed in the second column of the table and then locate the area of that symbol on the Soil Association Map, figure 31. Table 158 also shows the acreage and extent of the dominant land capability class for practical segments of the landscape.

Table 158 - Summary and Distribution of Land Capability Classes, Subregion 7, 1966

Land Capability Classes	Distribution by Soil Associations 1/			
	Soil Association Map Symbols 2/	1,000 Acres	Percent	Inventoried 1,000 Acres 3/
Class I - Soils in Class I have no limitations or hazards. They are adopted to all uses with a minimum of conservation treatment other than standard conditioning ones. 4/	-	-	-	20.0
Class II - Soils in Class II have few limitations or hazards. Simple conservation practices are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	-	-	-	555.8
Class III - Soils in Class III have more limitations and hazards than those in Class II. They require more difficult or complex conservation practices when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	1-4-5-8-9 11-12-14-18	5,403.0	28.8	1,974.2
Class IV - Soils in Class IV have greater limitations and hazards than Class III. Still more difficult or complex measures are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	3-10-16-19	1,980.6	10.5	3,037.5
Class V - Soils in Class V have more limitations than Class IV. They are generally unsuited for cultivation, but are well suited for grazing and forestry use. They require good management practices. 4/	-	-	-	34.0
Class VI - Soils in Class VI have severe limitations or hazards that make them generally unsuited for cultivation. They are suited largely to pasture, range, woodland or wildlife.	2-6-7-13-20-21 22-23-24-25-26	10,793.6	57.3	11,283.4
Class VII - Soils in Class VII have very severe limitations and hazards that make them generally unsuited for cultivation. They are suited to grazing, noncommercial, woodland or wildlife.	15-27	495.0	2.6	1,713.5
Class VIII - Soils and land forms in Class VIII have limitations and hazards that prevent their use for cultivated crops, pasture, range or woodland. They may be used for recreation, wildlife or water supply.	17	150.0	0.8	203.8
Total Land		18,822.2	100.0	18,822.2

1/ Class I and 10 percent of other capability classes may be included in areas of Class II. Up to 25 percent of other capability classes may be included in Classes III and IV. Class V and up to 40 percent of other capability classes may be included in Classes VI, VII, and VIII. In areas of rainfall less than 12 inches, large areas of Class VI can be potential Classes I through IV where irrigation water is available.
2/ Refer to the Subregional Soil Association Map, figure 31.
3/ Taken from table 8.
4/ Capability Classes I and V are distributed in small segregated areas over segments of the landscape. Many small areas could not be delineated on the map. This added detail, although still generalized, is commensurate with the subregional level of generalization.
Source: National Cooperative Soil Survey and U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Classified on table 159 is the dominant water storage capacity for each soil association in Subregion 7. Each class on the table relates to a similar class on the Water Storage Capacity, figure 4. To locate those areas having contrasting water storage capacity in the upper 5 feet of soil, refer to figure 4, to figure 31 (the subregional Soil Association Map), and to the following table. The class letter symbol in the first column and the Soil Association Map numerical symbol listed in the second column may be used to locate those areas having contrasting water storage capacity. Complete utilization of this storage contributes a more stable and sustained streamflow.

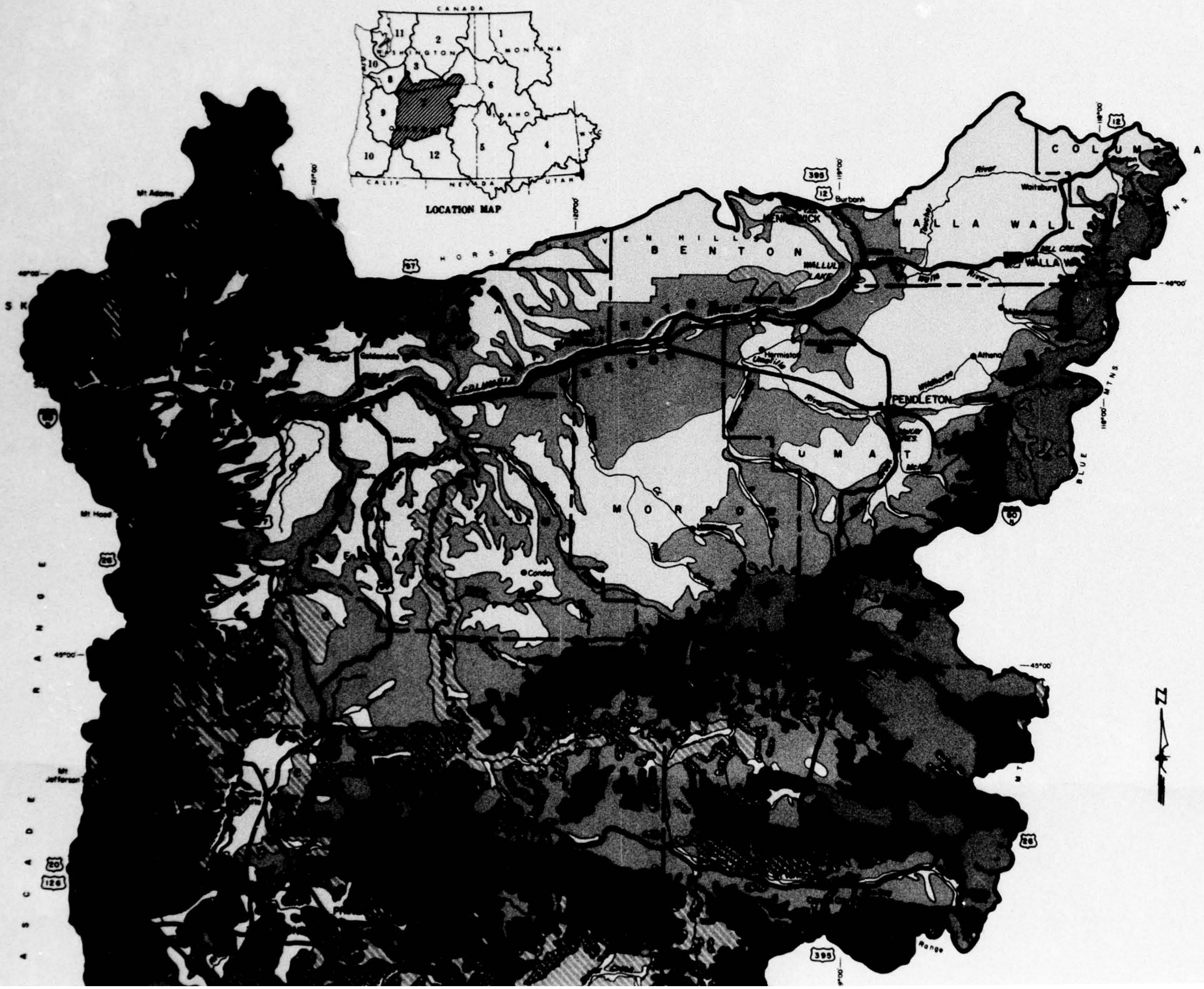
Table 159 - Water Storage Capacity of Soils Generalized to the Soil Associations, Subregion 7, 1966

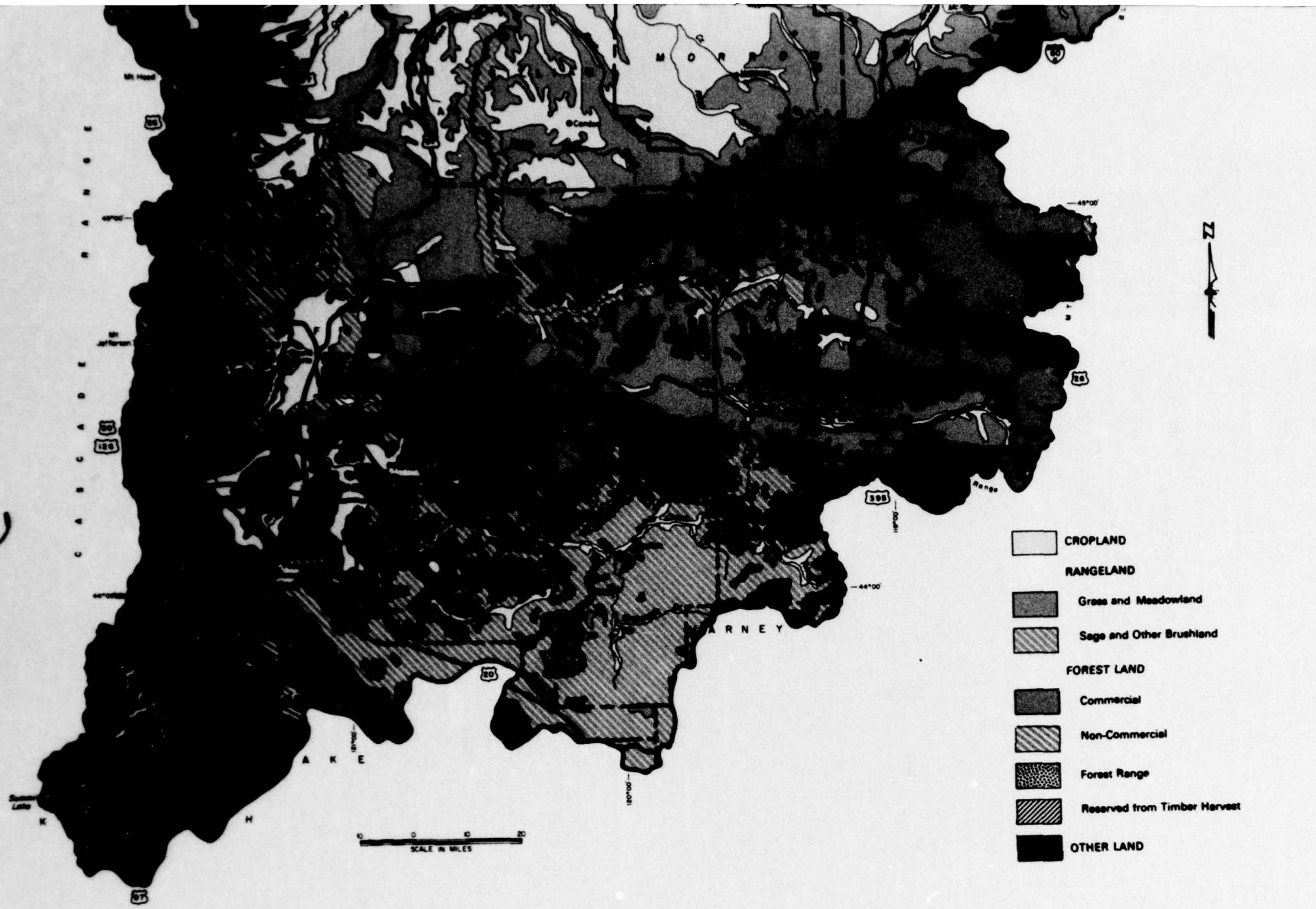
Water Storage Capacity 1/	Soil Association Symbols	1,000 Acres	Percent
Class A - Water storage in the soil profile more than 20,000 acre-feet per township.	9-10	1,615.6	8.5
Class B - Water storage in the soil profile 10,000 to 20,000 acre-feet per township.	1-4-5 8-11-12-14-21-22	7,823.6	41.6
Class C - Water storage in the soil profile 5,000 to 10,000 acre-feet per township.	2-3-6-7 13-15-16-17-18-19 20-23-24-25-26-27	9,383.0	49.9
Total		18,822.2	100.0

1/ Measurement of the water storage capacity is limited to the upper 5 feet of soil or to bedrock.
Source: National Cooperative Soil Survey.

Cover and Land Use

The four major cover and land uses as defined in the glossary and explained in the introduction have been summarized by acreage and ownership on tables 160 through 162. These broad categories have been determined both on the basis of cover and use. Cropland is more specifically a use category. Forest land has more than 10 percent forest cover. Rangeland areas have broad range cover characteristics. Other land includes land specifically based on use, such as urban, as well as that based specifically on cover characteristics, such as rock and sand dune areas. The four major categories have been generalized for presentation on figure 32. Since this information has been generalized, isolated areas of different cover and uses may occur within the broad patterns.


LOCATION MAP
CANADA
WASHINGTON
MONTANA
IDAHO
NEVADA
UTAH
CALIF
COLUMBIA
WALLA WALLA
BENTON
HORSE HEAVEN HILLS
MORROW
PENDLETON
KENNEWICK
WALLULA LAKE
Burbank
Waitsburg
Hermiston
Athena
Condon
Wasco
Goldendale
Mt Adams
Mt Hood
Mt Jefferson
CASCADE RANGE
BLUE MTNS
45°00'
46°00'
Range



COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

GENERALIZED COVER AND LAND USE

MID COLUMBIA, SUBREGION 7
1968

FIGURE 32

Table 160 - Cover and Land Use by Ownership, Subregion 7, 1966

Ownership	Cropland	Forest Land	Rangeland	Other Land	Total
			(1,000 acres)		
Department of Agriculture					
Forest Service	-	4,247.7	212.1	82.9	4,542.7
Other Agriculture	-	-	-	-	-
	-	4,247.7	212.1	82.9	4,542.7
Department of the Interior					
Bureau of Land Management	-	790.7	877.9	6.0	1,674.6
Bureau of Indian Affairs 1/	50.0	752.5	184.2	20.7	1,007.4
National Park Service	-	-	-	.1	.1
Fish & Wildlife Service	.2	-	.3	2.6	3.1
Bureau of Reclamation	12.0	7.0	49.5	6.2	74.7
Other Interior	-	-	-	3.3	3.3
	62.2	1,550.2	1,111.9	38.9	2,763.2
Department of Defense	-	-	110.2	49.0	159.2
Other Federal	-	-	-	.9	.9
Federal Subtotal	62.2	5,797.9	1,434.2	171.7	7,466.0
State	18.3	179.6	130.5	71.4	399.8
County	-	56.0	-	51.5	107.5
Municipal	-	4.0	-	17.8	21.8
Public Total	80.5	6,037.5	1,564.7	312.4	7,995.1
Private Total	3,490.1	2,290.8	4,793.4	252.8	10,827.1
Total Land Area	3,570.6	8,328.3	6,358.1	565.2	18,822.2

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land & Minerals Work Group.

Table 161 - Cover and Land Use by Ownership, State of Oregon, Subregion 7, 1966

Ownership	Cropland	Forest Land	Rangeland	Other Land	Total
			(1,000 acres)		
Department of Agriculture					
Forest Service	-	3,881.7	203.1	49.0	4,133.8
Other Agriculture	-	-	-	-	-
	-	3,881.7	203.1	49.0	4,133.8
Department of the Interior					
Bureau of Land Management	-	780.0	868.5	6.0	1,654.5
Bureau of Indian Affairs 1/	50.0	458.0	143.4	6.0	657.4
National Park Service	-	-	-	-	-
Fish & Wildlife Service	.2	-	.3	-	.5
Bureau of Reclamation	12.0	7.0	49.5	6.2	74.7
Other Interior	-	-	-	1.1	1.1
	62.2	1,245.0	1,061.7	19.3	2,388.2
Department of Defense	-	-	88.0	13.9	101.9
Other Federal	-	-	-	.7	.7
Federal Subtotal	62.2	5,126.7	1,352.8	82.9	6,624.6
State	.3	50.0	43.7	64.0	158.0
County	-	56.0	-	48.4	104.4
Municipal	-	2.0	-	14.4	16.4
Public Total	62.5	5,234.7	1,396.5	209.7	6,903.4
Private Total	2,257.9	1,747.3	4,322.2	135.8	8,463.2
Total Land Area	2,320.4	6,982.0	5,718.7	345.5	15,366.6

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.

Table 162 - Cover and Land Use by Ownership, State of Washington, Subregion 7, 1966

Ownership	Cropland	Forest Land	Rangeland (1,000 acres)	Other Land	Total
Department of Agriculture					
Forest Service	-	366.0	9.0	33.9	408.9
Other Agriculture	-	-	-	-	-
	-	366.0	9.0	33.9	408.9
Department of the Interior					
Bureau of Land Management	-	10.7	9.4	-	20.1
Bureau of Indian Affairs 1/	-	294.5	40.8	14.7	350.0
National Park Service	-	-	-	.1	.1
Fish & Wildlife Service	-	-	-	2.6	2.6
Bureau of Reclamation	-	-	-	-	-
Other Interior	-	-	-	2.2	2.2
	-	305.2	50.2	19.6	375.0
Department of Defense	-	-	22.2	35.1	57.3
Other Federal	-	-	-	.2	.2
Federal Subtotal	-	671.2	81.4	88.8	841.4
State	18.0	129.6	86.8	7.4	241.8
County	-	-	-	3.1	3.1
Municipal	-	2.0	-	3.4	5.4
Public Total	18.0	802.8	168.2	102.7	1,091.7
Private Total	1,232.2	543.5	471.2	117.0	2,363.9
Total Land Area	1,250.2	1,346.3	639.4	219.7	3,455.6

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.

Cropland

Cropland in Subregion 7 consists of about 15 percent irrigated and 85 percent dryland farmed crops. One area of irrigated cropland occurs on gravelly, sandy terraces along the Columbia River and its tributaries. The fruit orchards near Hood River, White Salmon, and The Dalles, and the row-specialty and forage cropland near Umatilla, Kennewick, and Burbank are all part of an irrigated area having an especially wide range of adapted crops and a long (about 210 day) growing season. Other areas of irrigated cropland are on the basalt plateau near Goldendale, Bend, Redmond, and Madras. Here the gravelly, sandy soils are high in volcanic ash, the length of growing season is shorter (about 120 days) and the number of adapted crops is somewhat restricted. The adapted row crop is principally potatoes; the specialty crop is peppermint. Part of the dry cropland follows a wheat-fallow cropping system,

Wheat-fallow rotation on undulating plateaus with moderately deep soils formed in loess. (S.C.S. Ore-15)

and part of it follows a wheat-pea system of cropping. Another part occurs on the better soil areas at higher elevations (generally above 3,500 feet) in scattered patches under a grain-hay, pasture cropping sequence. Table 163 shows the acreage and extent of representative categories of crops.

Table 163 - Cropland Acreage of Representative Categories of Crops by States, Subregion 7, 1966

Categories of Crops	Oregon	Washington (1,000 acres)	Total	Percent
Dryland Cropland 1/				
Close grown field crops	1,738.3	1,106.2	2,844.5	79.7
Forage crops	136.7	57.4	194.1	5.4
Orchards and vineyards	.5	6.1	6.6	.2
Total dryland crops	1,875.5	1,169.7	3,045.2	85.3
Irrigated Cropland 1/				
Forage crops	355.9	47.6	403.5	11.3
Orchards and vineyards	31.1	2.1	33.2	.9
Close grown field crops	18.1	9.9	28.0	.8
Row crops 2/	31.7	11.4	43.1	1.2
Specialty crops 3/	8.1	9.5	17.6	.5
Total irrigated crops	444.9	80.5	525.4	14.7
Total cropland	2,320.4	1,250.2	3,570.6	100.0

1/ Does not include other land that is irrigated (table 170).
2/ Includes sugar beets, potatoes, beans, corn, etc.
3/ Includes mint, vegetable seed, and other special and inextensive crops.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Forest Land

Forested land covers 8,328,300 acres or 44 percent of the total land area. Within the subregion, 45 percent of Oregon and 39 percent of Washington are forested. This cover is located along the backbone of the Cascade Range in Washington and Oregon, and in the Ochoco and Blue Mountains in Eastern Oregon.

Slightly over 6 million acres or 72 percent of the forest land is in public ownership. Of the public land, 70 percent is national forest, 25 percent is land administered by agencies within the Department of the Interior, and 5 percent is state and county owned. The balance, almost 2.3 million acres or 28 percent, is privately owned. Tables 164 through 166 detail this ownership.

Timber A little over 6.5 million acres of the forest area is classed as commercial forest land, mainly of the softwood variety. The major species is ponderosa pine. Other species in significant amounts include the Douglas-fir, lodgepole pine, and the fir-spruce types. The remaining 1.8 million acres are noncommercial, mostly western juniper found in the drier area. Only 170,000 acres are on lands reserved from cutting.

Table 164 - Forest Land Acreage by Generalized Type and Ownership, Subregion 7, 1966

Ownership	Commercial Forest Land	Non-Commercial Forest Land: Productive Reserved	Unproductive Reserved	Unproductive	Total
	(1,000 acres)				
Forest Service	3,855.6	90.1	70.3	231.7	4,247.7
Bureau of Land Management	118.0	-	-	672.7	790.7
Bureau of Indian Affairs 1/	609.6	-	-	142.9	752.5
National Park Service	-	-	-	-	-
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	-	-	-	7.0	7.0
Department of Defense	-	-	-	-	-
Other Federal	-	-	-	-	-
Federal Subtotal	4,583.2	90.1	70.3	1,054.3	5,797.9
State	136.2	8.0	6.0	29.4	179.6
County	32.0	-	-	24.0	56.0
Municipal	1.0	1.0	-	2.0	4.0
Public Total	4,752.4	99.1	76.3	1,109.7	6,037.5
Private Total	1,763.3	-	-	527.5	2,290.8
Grand Total	6,515.7	99.1	76.3	1,637.2	8,328.3

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest Experiment Station.

Table 165 - Forest Land Acreage by Generalized Type and Ownership, State of Oregon, Subregion 7, 1966

Ownership	Commercial Forest Land	Non-Commercial Forest Land: Productive Reserved	Unproductive Reserved	Unproductive	Total
	(1,000 acres)				
Forest Service	3,521.6	86.1	63.3	210.7	3,881.7
Bureau of Land Management	109.0	-	-	671.0	780.0
Bureau of Indian Affairs[1]	323.0	-	-	135.0	458.0
National Park Service	-	-	-	-	-
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation				7.0	7.0
Department of Defense	-	-	-	-	-
Other Federal	-	-	-	-	-
Federal Subtotal	3,953.6	86.1	63.3	1,023.7	5,126.7
State	9.0	8.0	6.0	27.0	50.0
County	32.0	-	-	24.0	56.0
Municipal	-	1.0	-	1.0	2.0
Public Total	3,994.6	95.1	69.3	1,075.7	5,234.7
Private Total	1,253.3	-	-	494.0	1,747.3
Grand Total	5,247.9	95.1	69.3	1,569.7	6,982.0

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest Experiment Station.

Table 166 - Forest Land Acreage by Generalized Type and Ownership, State of Washington, Subregion 7, 1966

Ownership	Commercial Forest Land	Non-Commercial Forest Land: Productive Reserved	Unproductive Reserved	Unproductive	Total
	(1,000 acres)				
Forest Service	334.0	4.0	7.0	21.0	366.0
Bureau of Land Management	9.0	-	-	1.7	10.7
Bureau of Indian Affairs[1]	286.6	-	-	7.9	294.5
National Park Service	-	-	-	-	-
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	-	-	-	-	-
Department of Defense	-	-	-	-	-
Other Federal					
Federal Subtotal	629.6	4.0	7.0	30.6	671.2
State	127.2	-	-	2.4	129.6
County	-	-	-	-	-
Municipal	1.0	-	-	1.0	2.0
Public Total	757.8	4.0	7.0	34.0	802.8
Private Total	510.0	-	-	33.5	543.5
Grand Total	1,267.8	4.0	7.0	67.5	1,346.3

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest Experiment Station.

Sixty-nine percent of the commercial forest land is in the sawtimber class, 22 percent is pole timber, and 7 percent saplings and seedlings; 2 percent is nonstocked. Only 95,000 acres of commercial forest land have been reserved from timber cutting by wilderness type classifications. The remaining commercial forest land supports almost 62 billion board feet of timber and, as such, is available to the subregion's forest products industries. These industries furnish 60 percent of the total manufacturing employment.

Forest Range The forest range includes 3.7 million acres classified as commercial forest land and 1.4 million acres classified as noncommercial forest. This 5.1 million acres represents 61 percent of the total forest land.

Some 35 percent of the forest range is in private ownership and 33 percent is under jurisdiction of the Forest Service. The remaining 32 percent is under other Federal agency control or is owned by state or local government. The Bureau of Land Management accounts for another 15 percent of the forest range and the Bureau of Indian Affairs 13 percent.

An estimated 27 percent of the forest range is in good condition, 35 percent in fair condition, and 38 percent in poor condition. The estimated carrying capacity is 510,000 AUMs with the public range accounting for 65 percent and the private range 35 percent.

With the exception of higher elevation forest lands along the eastern slopes of the Cascade Range, most forest land in the subregion is grazed or has potential for domestic livestock forage production. In the conifer forest areas, the understory includes bitterbrush, sagebrush, snowberry, nine-bark, and ocean spray. It also includes bluebunch wheatgrass, Idaho fescue, pine grass, needlegrass and elk sedge. A number of areas of western juniper noncommercial forest range are located in the southern part of the subregion.

Other Uses The forested lands are equally as important as waterhseds as they are the producers of the timber supply of the forest industries. Although only 44 percent of the subregion is forested, over 85 percent of its runoff is generated there. Over 80,000 people, representing 92 percent of the area's urban population, depend on forested watersheds for their source of domestic water.

The forest lands form a major part of the subregion's recreation resource, furnishing vast areas for hunting, fishing, and other outdoor activities. The public forest lands furnished areas and facilities for over 3.8 million recreation visits in 1965. These included use at developed campgrounds, winter sports areas, and the

general forest environment. The private forest lands furnish a much lesser but still significant part of the recreation resource, including several developed campgrounds. These lands also furnish the habitat for a significant portion of the big game found in the subregion. These include deer, elk, bear, and many varieties of smaller game. Some 740,000 hunter visits were reported on the forested portion of the subregion in 1965.

Rangeland

Rangeland in Subregion 7 comprises about 6.4 million acres of open grazing land, nearly 34 percent of the subregional land area, and 11 percent of all rangeland in the region. The forest range is about 27 percent of the total area. Tables 167 through 169 show the various categories of rangeland by ownership and state.

Table 167 - Rangeland and Forest Range Acreage by Range Type and Ownership, Subregion 7, 1966

	Federal					Non-Federal		
Category	BLM	FS	BIA	Other	Total	State & County	Private	Grand Total
				(1,000 acres)				
Rangeland								
Grasslands	115.3	135.0	38.6	132.0	420.9	63.6	2,825.5	3,310.0
Sagebrush	662.4	64.1	127.2	22.8	876.5	48.7	1,412.6	2,337.8
Brushland other than sage	100.2	13.0	18.4	5.2	136.8	18.2	555.3	710.3
Total	877.9	212.1	184.2	160.0	1,434.2	130.5	4,793.4	6,358.1
Forest Range1/								
Commercial Forest	106.7	1,500.6	550.7	-	2,158.0	116.0	1,401.4	3,675.4
Noncommercial Forest								
Sub-alpine	-	.1	7.0	-	7.1	1.0	1.0	9.1
Desert Fringe	672.7	176.3	111.7	3.5	964.2	52.0	401.0	1,417.2
Total (noncommercial)	672.7	176.4	118.7	3.5	971.3	53.0	402.0	1,426.3
Total (forest range)	779.4	1,677.0	669.4	3.5	3,129.3	169.0	1,803.4	5,101.7
Grand Total	1,657.3	1,889.1	853.6	163.5	4,563.5	299.5	6,596.8	11,459.9

1/ Forest and woodland grazed or potentially usable for forage production. The forest range acreage is included within the total forest statistics shown in table 164.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Table 168 - Rangeland and Forest Range Acreage by Range Type and Ownership, State of Oregon, Subregion 7, 1966

	Federal					Non-Federal		
Category	BLM	FS	BIA	Other	Total	State & County	Private	Total
				(1,000 acres)				
Rangeland								
Grasslands	109.1	133.0	31.3	122.8	396.2	28.0	2,721.1	3,145.3
Sagebrush	659.4	64.1	97.9	15.0	836.4	15.7	1,149.4	2,001.5
Brushland other than sage	100.0	6.0	14.2	-	120.2	-	451.7	571.9
Total	868.5	203.1	143.4	137.8	1,352.8	43.7	4,322.2	5,718.7
Forest Range1/								
Commercial Forest	97.7	1,477.8	265.5	-	1,841.0	6.0	1,192.6	3,039.6
Noncommercial Forest								
Sub-alpine	-	.1	-	-	.1	-	-	.1
Desert Fringe	671.0	176.3	111.7	3.5	962.5	51.0	400.0	1,413.5
Total (noncommercial)	671.0	176.4	111.7	3.5	962.6	51.0	400.0	1,413.6
Total (forest range)	768.7	1,654.2	377.2	3.5	2,803.6	57.0	1,592.6	4,453.2
Grand Total	1,637.2	1,857.3	520.6	141.3	4,156.4	100.7	5,914.8	10,171.9

1/ Forest and woodland grazed or potentially usable for forage production. The forest range acreage is included within the total forest statistics shown on table 164.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Table 169 - Rangeland and Forest Range Acreage by Range Type and Ownership, State of Washington, Subregion 7, 1966

Category	Federal					Non-Federal		Grand Total
	BLM	FS	BIA	Other	Total	State & County	Private	
				(1,000 acres)				
Rangeland								
Grasslands	6.2	2.0	7.3	9.2	24.7	35.6	104.4	164.7
Sagebrush	3.0	-	29.3	7.8	40.1	33.0	263.2	336.3
Brushland other than sage	.2	7.0	4.2	5.2	16.6	18.2	103.6	138.4
Total	9.4	9.0	40.8	22.2	81.4	86.8	471.2	639.4
Forest Range1/								
Commercial Forest	9.0	22.8	285.2	-	317.0	110.0	208.8	635.8
Noncommercial Forest								
Sub-alpine	-	-	7.0	-	7.0	1.0	1.0	9.0
Desert Fringe	1.7	-	-	-	1.7	1.0	1.0	3.7
Total (noncommercial)	1.7	-	7.0	-	8.7	2.0	2.0	12.7
Total (forest range)	10.7	22.8	292.2	-	325.7	112.0	210.8	648.5
Grand Total	20.1	31.8	333.0	22.2	407.1	198.8	682.0	1,287.9

1/ Forest and woodland grazed or potentially usable for forage production. The forest range acreage is included within the total forest statistics shown on table 164.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

More than half of the rangeland is found on the Columbia Plateau in a broad, contiguous area interspersed with cultivated lands, extending eastward from the forested east slopes of the Cascade Range and northward from the Ochoco Mountains. In the south-central part, smaller concentrations are found along the John Day River and its tributaries in the Ochoco Mountain area, and interspersed with forest lands in the northwestern approaches to the Harney Basin.

It is estimated that about 45 percent of the rangeland is in poor range condition, 36 percent is in fair condition, and only 19 percent is in good condition. The estimated carrying capacity is 955,000 AUMs, with the private range accounting for 84 percent and the public range 16 percent.

Privately owned rangeland covers 4.8 million acres and represents 75 percent of all range in the subregion. Another 23 percent is owned by the Federal Government, including 878,000 acres managed by the Bureau of Land Management, 212,000 acres under the Forest Service, and 184,000 acres administered by the Bureau of Indian Affairs. The remaining 2 percent is state owned.

Grasslands, including perennial grasses and forbs, and lesser areas of meadowland, account for 52 percent of the range. About 21 percent is in good condition, another 33 percent in fair condition, and the remaining 46 percent in poor condition. Grasslands dominate the range on the Columbia Plateau although they are interspersed with sage and other brush. At lower elevations along the Columbia River where precipitation ranges from 7 to 10 inches, cheatgrass is predominant with some bluebunch wheatgrass, Sandberg bluegrass, needlegrass, and squirreltail. These areas are in relatively poor condition. Bunchgrass is found in the foothills at intermediate elevations on rolling uplands and in major cropland areas on the steeper noncultivated areas with shallow soils.

Principal range types in these areas are the bluebunch wheatgrass-Sandberg bluegrass combination or the Idaho fescue-bluebunch wheatgrass combination. These range areas are in fair to good condition.

Sagebrush covers 37 percent of the range. It is estimated that 17 percent is in good condition, 39 percent in fair condition, and 44 percent in poor condition. Sagebrush is interspersed with grasslands throughout most of the subregion and is predominant on southern foothills of the Ochoco Mountains and between these mountains and the east slope of the Cascades. Precipitation in the sagebrush areas ranges from 10 to 20 inches with the greater proportion coming as snow or winter rain.

Brushland other than sage accounts for the remaining 11 percent. Approximately 18 percent is in good range condition, 38 percent in fair condition, and 44 percent in poor condition. Principal nonforest browse types are the bitterbrush-bluebunch wheatgrass range in more rocky or shallow soil areas and the rabbitbrush-bitterbrush and mixed grass ranges on sandy sites. These range types are intermingled with grassland and sage at lower elevations, and with forest cover in higher elevations.

Other Land

The other land use in Subregion 7 consists of 565,200 acres or about 3 percent of the land area. This includes barren land and rock that make up about 61 percent of the total. About 32 percent of the total is urban, industrial areas, farmsteads, airports, roads, and other miscellaneous use areas. Almost 7 percent consists of water areas less than 40 acres and streams less than one-eighth mile wide. Table 170 shows the acreage and extent of other land in the Mid Columbia Subregion.

Table 170 - Other Land, Subregion 7, 1966

Kinds of Land Use	Oregon	Washington	Total	Percent
	(1,000 acres)			
Barren	182.3	163.7	346.0	61.2
Roads and railroads	71.2	30.7	101.9	18.0
Small water[1/]	33.6	2.8	36.4	6.5
Miscellaneous[2/]	58.4	22.5	80.9	14.3
Total other land	345.5	219.7	565.2	100.0

1/ Water areas less than 40 acres in size and streams less than one-eighth mile in width.
2/ Includes urban and industrial areas, farmsteads, airports, and other areas.
Source: Compiled by the Soil Conservation Service River Basin Staff.

MINERAL RESOURCES

Metals

This subregion lies between the Cascade Range on the west and the Blue Mountains on the east. The Blue Mountains include the Strawberry, and parts of the Ochoco, Greenhorn, and Elkhorn Ranges; these mountains have been important mining areas in the past. Some of the first gold discoveries in the Columbia-North Pacific were on the John Day River. Areas of granitic and similar intrusive rocks of Jurassic age underlie parts of the Blue Mountains, and ultramafic serpentine and periodotite intrusives are found both east and west of Canyon City in Grant County. Metallic mineral deposits (except the mercury deposits) are related in origin to these intrusives. The mercury deposits in the Ochoco District are in Eocene volcanic flow rocks. The southern part of the subregion is predominantly covered by basalt flows of Quaternary age related to the Snake River basalt; a large part of the central part of the subregion is underlain by Eocene andesitic and basaltic rocks; and the northern portion of the subregion is covered by Columbia River basalt of Oligocene-Miocene age. The older basalt flows are an unfavorable geologic environment for metallic mineral deposits.

The upper reaches of the John Day River contain the most important metal mining districts and account for the major metal production (figure 33, table 171). Near the headwaters of the North Fork of the John Day is located a part of the Cable Cove and Granite

Table 171 - Mining Districts, Subregion 7

Index No. Fig.	District	County	Drainage	Size of Districts - Production Plus Potential Reserves 1/ Gold	Silver	Copper	Lead	Zinc	References
1	Cable Cove	Baker Grant	Headwaters of N.Fk. of John Day and Powder Rivers.	1 1/	2 1/	3 1/	3 1/	-	Lorain, S.H., 1938, BuMines Inf.Circ. 7015
2	Granite	Grant	Granite Creek, tributary to N. Fork John Day River	1	1	3	3	3 1/	Koch, G. S., Jr., 1959, Oreg. Dept. of Geol. & Miner. Ind. Bull. 49, 49 pp.
3	Greenhorn	do	Headwaters of Middle Fork John Day River	2	1	3	3	-	Parks, H.M., and Swartley, 1916, Oreg. Bur. Mines & Geol. Miner. Res. of Oreg., v. 2, No. 4.
4	Canyon	do	Upper John Day River and tributary Canyon Creek	1	2	-	-	-	Thayer, T.P., 1940, U.S.Geol.Survey Bull. 922-D. Swartley, A.M., 1914, Oreg. Bur. Mines & Geol. Miner. Res. of Oreg., v.1, No. 8.
5	Ashwood	Jefferson	Trout Creek, tributary to Deschutes River and Muddy Creek, tributary to John Day River	3 Produced about 17,400 flasks of mercury.	2	-	-	-	Brooks, H.C., 1963, Oreg. Dept. of Geol. & Miner. Res. Bull. 55, pp. 116-167
6	Ochoco	Crook	Headwaters of Ochoco Creek, tributary to Crooked River and of North Fork of Crooked River	3 Produced about 2,600 flasks of mercury.	3	-	3	-	Brooks, H.C., 1963, Oreg. Dept. of Geol. & Miner. Res. Bull. 55, pp. 116-167.

1/ Size

Index	Gold (Troy Ounces)	Silver (Troy Ounces)	Copper (Net Tons)	Lead (Net Tons)	Zinc (Net Tons)
1	100,000 - 1,000,000	500,000 - 1,000,000	10,000 - 100,000	10,000 - 100,000	10,000 - 100,000
2	10,000 - 100,000	100,000 - 500,000	1,000 - 10,000	1,000 - 10,000	1,000 - 10,000
3	1,000 - 10,000	10,000 - 100,000	Less than 1,000	Less than 1,000	Less than 1,000

districts. The Cable Cove District has produced more than 100,000 ounces of gold and 100,000 ounces of silver from both lode and placer deposits; however, all but a very small part of this production came from the eastern side of the divide in Baker County as is described in the report on Subregion 5. The Granite District is also in both Grant and Baker counties and thus partly outside Subregion 7. Total production has been more than 100,000 ounces of gold, 400,000 ounces of silver, 34 tons of copper, 138 tons of lead, and 9 tons of zinc.

The upper reaches of the Middle Fork of the John Day River contain the Greenhorn District. This district likewise extends into the Upper Burnt River drainage in Baker County outside Subregion 7. Total production has been more than 16,000 ounces of gold, 454,000 ounces of silver, and a small amount of copper and lead.

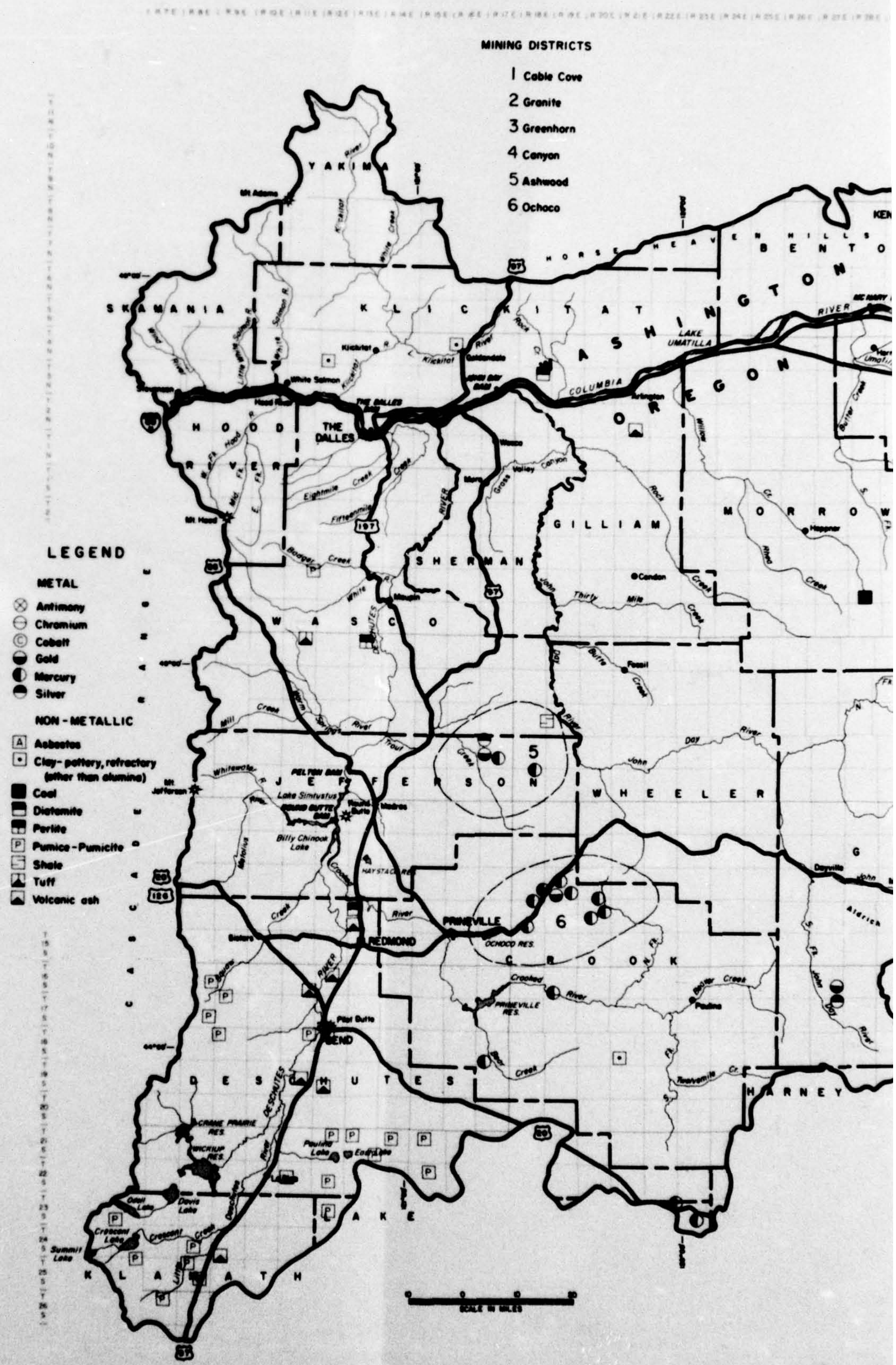
The upper main stem of the John Day River, in the vicinity of the town of John Day, contains the Canyon District that has produced from both placer and lode deposits more than 150,000 ounces of gold, 17,000 ounces of silver, and a small tonnage of chromite ore.

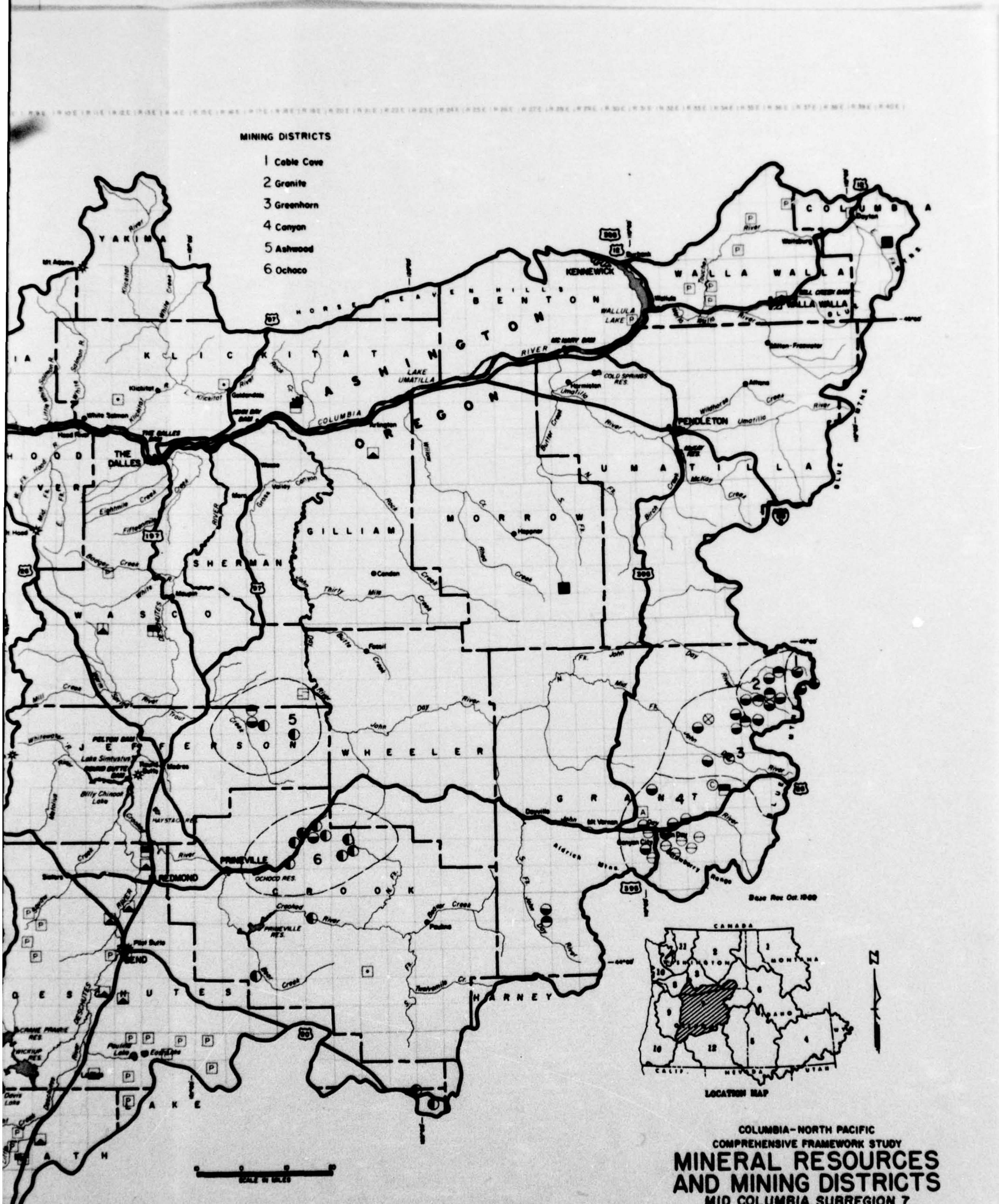
The central part of the Deschutes drainage, including the Crooked River and Ochoco Creek, are underlain by Eocene volcanics and contain deposits of gold, silver, copper, lead, zinc, and mercury. The Ashwood District in the headwater drainage of Trout Creek has produced about 17,400 flasks; more than 17,000 flasks have come from the Horse Heaven mine. This mine has been closed for several years.

The Ochoco District near the headwaters of Ochoco Creek and North Fork of the Crooked River has produced about 2,600 flasks of mercury. There is very little present output. Jefferson County produced silver, lead, gold, copper, and zinc, in that order of value, in 1965. Crook County produced some mercury.

Nonmetals

The Walla Walla River drainage is underlain by Columbia River basalt; some alluvial clay deposits occur near Walla Walla and Dayton, which were formerly mined for brick and tile. Numerous basalt quarries are operated intermittently when crushed stone is needed for roadrock or aggregate. Sand and gravel comes from alluvial terrace and river bed deposits. During 1965, in Walla Walla County, sand and gravel ranked first and stone (basalt) second in order of value of minerals produced, and in Columbia County, stone was first and sand and gravel second. No other minerals were produced.


MINING DISTRICTS
1 Cable Cove
2 Granite
3 Greenhorn
4 Canyon
5 Ashwood
6 Ochoco
LEGEND
METAL
Antimony
Chromium
Cobalt
Gold
Mercury
Silver
NON-METALLIC
Asbestos
Clay-pottery, refractory (other than alumina)
Coal
Diatomite
Perlite
Pumice-Pumicite
Shale
Tuff
Volcanic ash
YAKIMA
SKAMANIA
KLICKITAT
BENTON
WASHINGTON
OREGON
HOOD RIVER
THE DALLES
GILLIAM
MORROW
SHERMAN
WASCO
JEFFERSON
WHEELER
CROOK
PRINEVILLE
REDMOND
BEND
DESCHUTES
HARNEY
LAKE
KLAMATH
CASCADE RANGE
COLUMBIA
LAKE UMATILLA
HORSE HEAVEN HILLS
Mt Adams
Mt Hood
Mt Jefferson
Condon
Fossil
Heppner
OCHOCO RES.
PRINEVILLE RES.
CRANE PRAIRIE RES.
WICKIUP RES.
Davis Lake
Crescent Lake
Summit Lake
Odell Lake
Paulina Lake
East Lake
PELTON DAM
Lake Simtustus
Billy Chinook Lake
John Day River
Crooked River
SCALE IN MILES


MINING DISTRICTS
1 Cable Cove
2 Granite
3 Greenhorn
4 Canyon
5 Ashwood
6 Ochoco
YAKIMA
KLICKITAT
BENTON
WASHINGTON
WALLA WALLA
COLUMBIA
OREGON
UMATILLA
MORROW
GILLIAM
SHERMAN
WASCO
HOOD RIVER
JEFFERSON
WHEELER
GRANT
CROOK
DESCHUTES
HARNEY
LAKE
KLAMATH
KENNEWICK
PENDLETON
THE DALLES
PRINEVILLE
REDMOND
BEND
WALLULA LAKE
LAKE UMATILLA
COLUMBIA RIVER
OCHOCO RES.
PRINEVILLE RES.
COLD SPRINGS RES.
Base Rev. Oct. 1966
LOCATION MAP
CANADA
SCALE IN MILES
COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY
MINERAL RESOURCES
AND MINING DISTRICTS
MID COLUMBIA, SUBREGION 7
FIGURE 33

7

The Umatilla River and Willow Creek drainages are also underlain by Columbia River Basalt, covered by Quaternary alluvium over large areas. In Umatilla County, stone (basalt) ranked first and sand and gravel second, and in Morrow County, sand and gravel was first and stone second in value of mineral production in 1965. No other minerals were produced.

The lower John Day River drainage from the confluence of the North and Middle Forks downstream to the Columbia River is predominantly underlain by Columbia River Basalt of Oligocene-Miocene age and andesites and basalts of Eocene age. Gilliam County produced stone (basalt), pumice, and sand-gravel in that order of value in 1965; pumice came from deposits near Shutler; Sherman County produced sand and gravel and stone (basalt) in 1965; Wheeler County produced only sand and gravel. In Jefferson County, sand and gravel ranked first in value of production for 1965.

The lower Deschutes River drainage is underlain by Columbia River Basalts. Sand and gravel and stone (basalt) were the only minerals produced in Sherman and Wasco counties in 1965.

The upper drainage of the Deschutes River is predominantly covered by volcanic materials such as ash, cinders, pumice, and basalt of Quaternary and Holocene age. Several pumice and volcanic cinder operations have produced in this area. Deschutes County reported pumice, stone, and sand and gravel production in that order of value for 1965.

The Hood River drainage is underlain by Tertiary volcanics, including the Columbia River Basalt and younger volcanic rocks. Sand and gravel and stone were the only minerals produced in Hood River County in 1965. The stone (basalt) is quarried for crushed stone used mostly for roadstone.

The part of the subregion north of the Columbia River in the Salmon, Walla Walla, and Klickitat River drainages, is also underlain predominantly by the Columbia River Basalt mantled in some areas by sand and gravel and alluvium. Klickitat County produced stone (basalt), sand and gravel, and carbon dioxide in that order of value in 1965; Benton County produced stone, sand and gravel; Walla Walla County produced sand and gravel and stone; and Columbia County produced stone, sand and gravel. Value of production was in the order named. There were no other mineral products from these counties in 1965.

Present Mineral Industry and Outlook for the Future

Metals

Most of the gold and silver produced in Oregon in 1965, (499 ounces of gold and 8,800 ounces of silver) came from the Buffalo mine in Grant County and Oregon King mine in Jefferson County. Very small amounts of copper, lead, and zinc were recovered as byproduct of gold and silver ores. The imbalance between the present price of gold and the costs of production has discouraged the gold producer. A more favorable economic climate for gold and silver would likely increase the output of these metals together with copper, lead, and zinc.

Mercury A few flasks of mercury were produced in Grant and Crook counties in 1965. In recent years there has been very little mercury mining in the formerly productive mercury districts in Jefferson and Crook counties. Mercury reserves in this area appear to be depleted, and no new discoveries have been made recently.

Chromite Chromite was produced at several small properties in the Canyon District, near Canyon City, Grant County, during the period of Government stockpile purchases and incentive payments. Currently all the properties are inactive, and potential for future production depends on higher market price or another Government-subsidized purchase program for chromite.

Nonmetals

Stone (basalt) and sand and gravel are the most important mineral products in recent years in terms of total value of production. Output of these mineral products in 1965 was valued at more than $15 million. The basalt is mostly crushed and used for roadstone or aggregate.

Construction Materials Pumice or volcanic cinder is quarried at sites near Bend in Deschutes County and has been used for lightweight aggregate, cinder blocks and other building materials.

The construction materials, stone, sand and gravel, and volcanic cinder and pumice are available in virtually inexhaustible deposits. Future production depends on marketability of these products.

Bentonite Bentonite is produced in Crook County and used for forest fire retardant, binder in stock feed pellets, and as a sealant for irrigation ditches and stock ponds. The bentonite and bentonitic clay deposits will probably supply all demands for their products for the foreseeable future.

Gem Stones The subregion is notable for semiprecious gem materials such as agate, jasper, and obsidian, and particularly for its "thundereggs" found in Jefferson and Crook counties. Prineville, Crook County, is the meeting place once a year for the "Rockhound Pow Wow" where between 10 and 20 thousand rock collectors congregate. The gem materials provide recreation and a hobby for thousands of amateur collectors, and a continuation of "rockhounding" is expected in the future.

Mineral Fuels

There are no significant deposits of mineral fuels in the subregion. Some noncommercial coal beds are located in Umatilla and Morrow counties.

SUBREGION 8
LOWER COLUMBIA

ABSTRACT

The Lower Columbia Subregion has the smallest area of any subregion in the Columbia-North Pacific Region. Most of the land is under natural forest cover. Originally, the entire subregion, with the exception of the alpine areas, was covered with a dense stand of fir-hemlock forest. About 16 percent has been diverted to cropland, rangeland, and other uses. There will probably be further reduction of the forested areas in the years ahead.

The high mountainous uplands on the east side of the subregion have soils formed mainly in residuum/colluvium from basic igneous bedrock mixed with an overburden of volcanic ash and pumice. Precipitation ranges from 80 to 120 inches falling as snow and rain from November 1 through April. The frost-free period varies from 100 to 140 days. The elevations generally range from 3,000 feet to 8,500 feet above sea level. Problems of use relate to steep slopes, shallow and rocky soils, and influences of volcanic ash and pumice in soil parent material.

The forest cover has been removed on fans, foothills, terraces, and bottomlands; and 201,100 acres (6 percent) are cropland; 67,900 acres (2 percent) are rangeland; and 106,300 acres (3 percent) are devoted to other land uses.

Soils in this area are formed in alluvium on bottomlands and terraces and in residuum/colluvium from underlying sedimentary bedrock on low mountains and foothills and in places volcanic ash or wind deposited silt overburn is mixed in. Precipitation ranges from 45 to 60 inches falling as rain mostly from November 15 through March 15. The frost-free period varies from 140 to 200 days. The elevation generally ranges from 100 to 3,000 feet above sea level. Problems of use relate to drainage to overcome soil wetness and steep slopes.

Mercury has been the most important metallic mineral produced. Deposits are found in the Morton mercury district in close proximity to coal beds; some of the richest ore has been found in the coal. Two mines in the district produced 6,500 flasks in the period 1926-35. There is no present production, but some potential production exists.

Copper, gold, and silver, with minor amounts of associated

lead, zinc, and vanadium, are found in deposits near Spirit Lake and Mount Margaret and near the headwaters of West Fork of the Washougal River. Extensive exploration work has been done on some of the prospects, but very little production has resulted from these efforts. Gold placers have been worked on McCoy Creek and on the East Fork Lewis River.

Coal fields of minor importance occur in the Kelso, Castle Rock, Morton, and Cinebar Districts. Production has been small. Total coal resources are estimated to be about 200 million tons, some of which can be mined by strip mining methods.

Clay is an important mineral resource. High-alumina clay potentially valuable to the aluminum industry occurs about 7 miles northeast of Castle Rock; reserves are about 17 million tons averaging about 29 percent alumina content. Ferruginous bauxite resulting from lateritic weathering of basalt occurs over large areas in Columbia County, Oregon, and extends into Cowlitz County, Washington. The very large tonnage of this material makes it important as a future potential source of raw material for the aluminum industry.

The total watershed area of Subregion 8 consists of almost 98 percent land and slightly more than 2 percent water. Table 172 shows the land, water, and total watershed acreages of Subregion 8 by states and counties. Except for this table, only areas of land will be recorded throughout the following discussion.

Table 172 - Areas by State and County, Subregion 8, 1967

State and County	Water Area		Land Area1/		Total Area	
	Sq. Mi.	Acres	Sq. Mi.	Acres	Sq. Mi.	Acres
Oregon						
Columbia	09.6	6,200	254.1	162,600	263.7	168,800
Total Oregon	09.6	6,200	254.1	162,600	263.7	168,800
Washington						
Clark	30.9	19,800	627.1	401,300	658.0	421,100
Cowlitz	27.2	17,400	1,135.8	726,900	1,163.0	744,300
Lewis	06.3	4,000	1,458.3	933,400	1,464.6	937,400
Pacific	.0	0	72.5	46,400	72.5	46,400
Pierce	.0	0	66.3	42,500	66.3	42,500
Skamania	18.0	11,500	1,106.1	707,900	1,124.1	719,400
Wahkiakum	22.5	14,400	245.1	156,800	267.6	171,200
Yakima	00.3	200	23.2	14,800	23.5	15,000
Total Washington	105.2	67,300	4,734.4	3,030,000	4,839.6	3,097,300
Total Subregion	114.8	73,500	4,988.5	3,192,600	5,103.3	3,266,100

1/ The term "land" is defined to include all water bodies under 40 acres and streams under one-eighth mile in width.
Source: U.S.D.A. Conservation Needs Inventory adjusted to U.S. Census.

LAND

Factors of major importance to the land resource are: the ownership status, the soils, and the present use. The combination of these factors greatly influences the present and future utilization of the land resource.

Land Ownership

Subregion 8 contains almost 3.2 million acres. Private lands make up the largest single group of ownerships with nearly 1.9 million acres or 58 percent of the total land area. The Federal Government is next with more than a million acres or 32 percent of the total. State, county, and municipal ownerships make up the remaining 10 percent.

Almost 930,000 acres of the public lands are national forests. Another 80,000 acres are miscellaneous Federal holdings within the Departments of the Interior and Defense. State, county, and municipal ownerships amount to 325,000 acres. About 1,000 acres are Indian lands. Table 173, Land Ownership, and Figure 34, Land Ownership Map, show this information in more detail.

Table 173 - Land Ownership Acreage, Subregion 8, 1965

Administering Agencies	Washington	Oregon	Total Subregion 8
		(1,000 acres)	
Department of Agriculture			
Forest Service	924.8	-	924.8
Other Agriculture	-	-	-
Subtotal	924.8	-	924.8
Department of the Interior			
Bureau of Land Management	1.2	.6	1.8
Bureau of Indian Affairs 1/	1.7	-	1.7
National Park Service	71.2	-	71.2
Fish & Wildlife Service	-	-	-
Bureau of Reclamation	-	-	-
Other Interior	2.4	-	2.4
Subtotal	76.5	.6	77.1
Department of Defense	3.1	-	3.1
Other Federal	.1	-	.1
Federal Subtotal	1,004.5	.6	1,005.1
State	296.2	6.0	302.2
County	7.3	.6	7.9
Municipal	13.1	1.6	14.7
Public Non-Federal Subtotal	316.6	8.2	324.8
Total Public	1,321.1	8.8	1,329.9
Total Private	1,708.9	153.8	1,862.7
Grand Total	3,030.0	162.6	3,192.6

1/ Private lands held in trust by the Federal Government.
Source: General Services Administration Real Property Owned by the United States as of June 30, 1965, adjusted by the Land and Minerals Work Group.

Soils

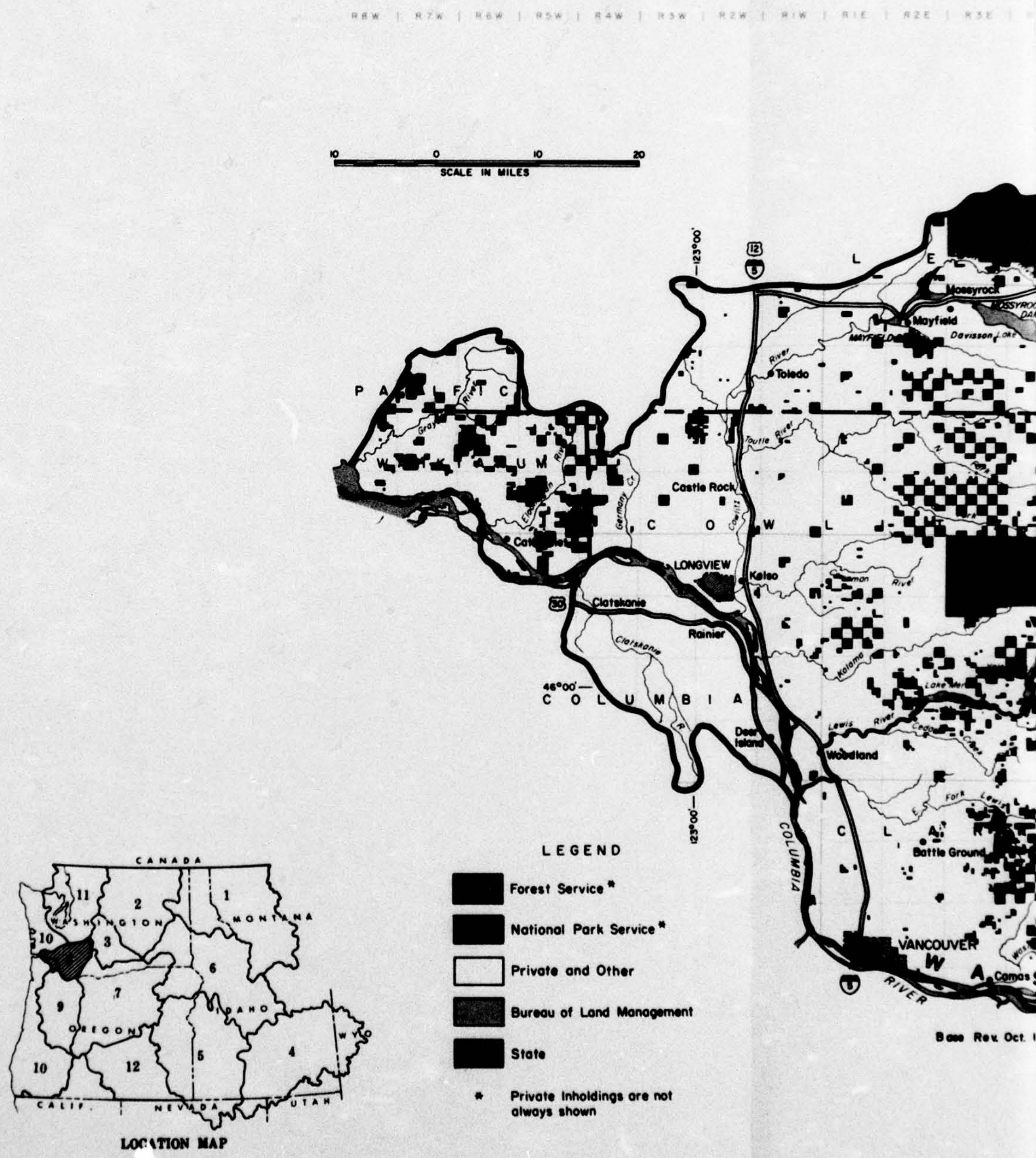
Figure 35, the Soil Associations Map, shows the location and relative extent of each soil association. The associations are numbered in a general relationship to the position in the landscape. Thus bottomlands and low terraces have the lowest numbers and alpine areas have the highest. The name of each association relates to the soil series representing general kinds of soil that are most extensive in the landscape. Wherever possible, established soil series are used in the name; however, where the soil series do not have classification status, the soil series name is not recorded. Generally up to 15 percent of any soil association in known areas may consist of inclusions of soils other than those identified. Such inclusions may be similar soils or they may be highly contrasting. However, in many high mountainous areas where detailed knowledge about the area is incomplete, extensive areas are included within delineations and inclusions of other soils may exceed the 15 percent general average.

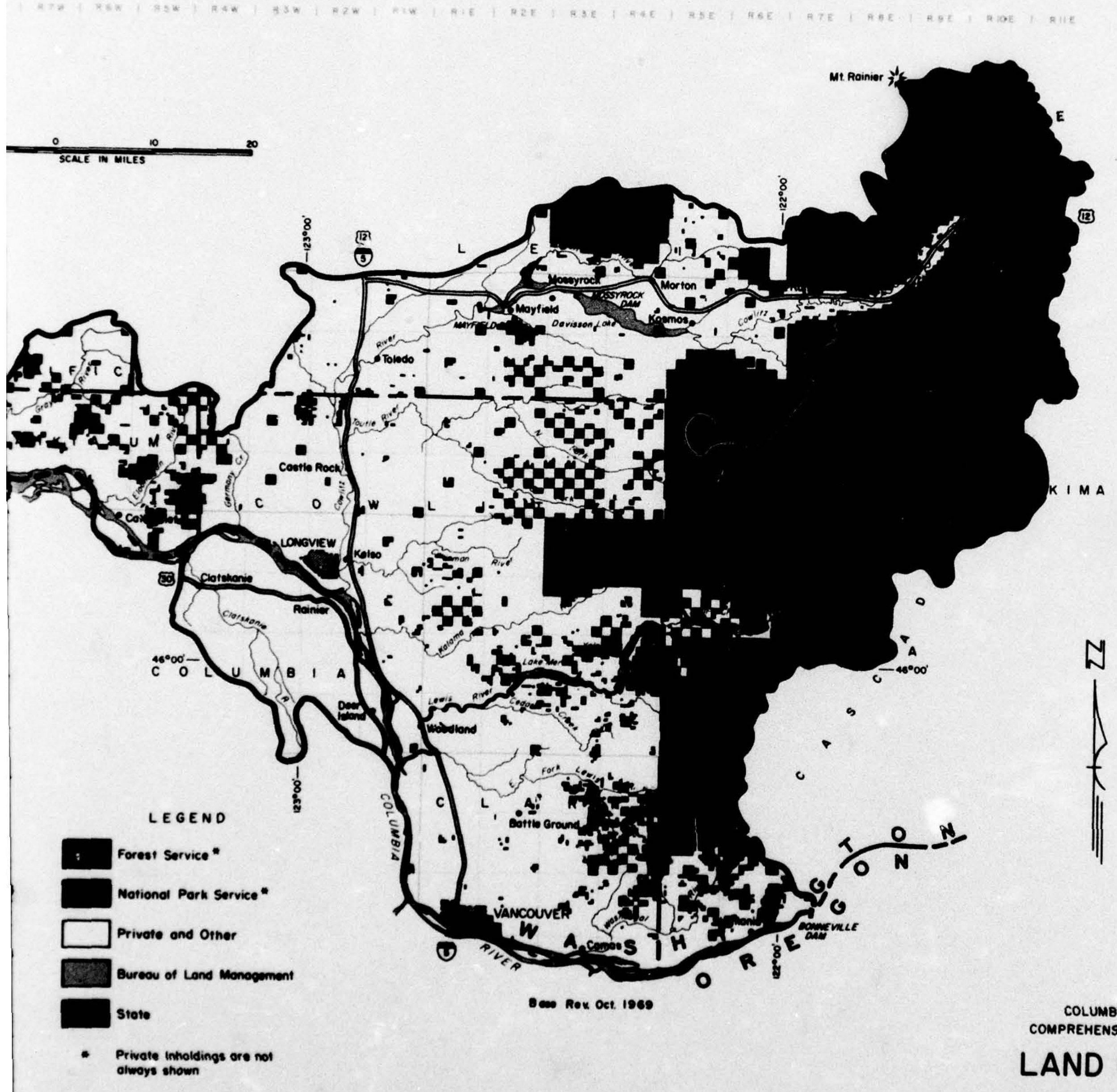
Table 174 contains information about each soil association shown on figure 35. The symbol listed in the second column on the table is the same symbol shown on the soil association map. The table is organized to show land characteristics and the characteristics, qualities, and some interpretations of soil series representing the dominant and the contrasting kinds of soil in each association. The first six columns show some general land characteristics for each soils association. The next 11 columns show characteristics (permanent soil facts) of individual key soil series that represent dominant and contrasting soils. The following four show qualities inferred from the characteristics of these soils and the last four columns show interpretations concerning agricultural use based upon the foregoing soil characteristics and qualities. All of the representative soil series listed have status in classification. A blank space in the soil series column indicates that the soil series name has no classification status.

The "soil groups" column contains associations that have broad similarities in some important characteristics, frequently identified with a position on the landscape.

The "percentage of association" column shows the extent of each soil in an association. Differences of the total soil percentage in each association from 100 percent are inclusions of other soils and land types. For example, soil association 3 lists a total of 55 percent. Knowledge of this area is limited so 45 percent of the area consists of inclusions of soils that have not been defined.

Terms listed for permeability of water through the subsoil and permeability of substratum are:


R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E
10 0 10 20
SCALE IN MILES
123°00'
PACIFIC
WAHKIAKUM
COWLITZ
COLUMBIA
LEWIS
CLARK
Mossyrock
Mayfield
Davisson Lake
Toledo
Toutle River
Castle Rock
Cathlamet
Grays River
Elochoman River
Germany Cr.
Cowlitz
LONGVIEW
Kelso
Clatskanie
Rainier
Kalama River
Lake Merwin
Lewis River
46°00'
Deer Island
Woodland
Battle Ground
VANCOUVER
Camas
COLUMBIA RIVER
LEGEND
Forest Service *
National Park Service *
Private and Other
Bureau of Land Management
State
* Private inholdings are not always shown
CANADA
WASHINGTON
MONTANA
OREGON
IDAHO
CALIF.
NEVADA
UTAH
WYO
1
2
3
4
5
6
7
9
10
11
12
LOCATION MAP
Base Rev. Oct.



COLUMBIA–NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

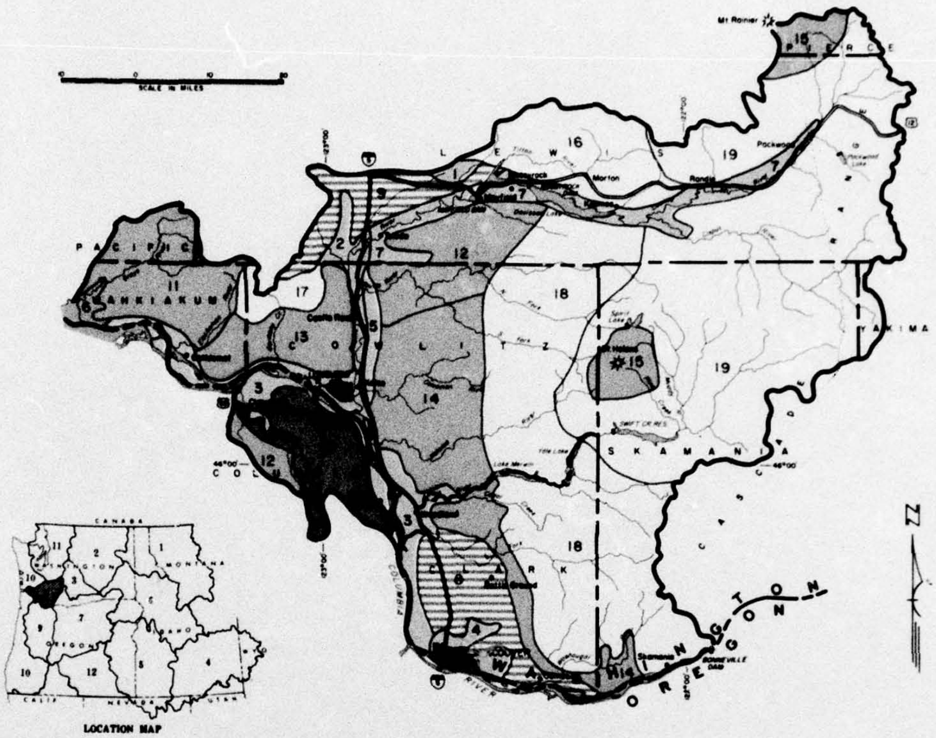
LAND OWNERSHIP

LOWER COLUMBIA, SUBREGION 8

1968

FIGURE 34

2



LEGEND REVISED 1970

LEGEND

Soil Associations Name of Association
Map Symbol *

Generally silty and sandy soils formed in alluvial sediments on bottomlands and low terraces.

1	Chehalis - Cloquato
2	Newberg - Clato
3	Sauvie - Pilchuck
4	Lauren - Sifton
5	Toutle - Kalama
6	Nehalem - Brenner
7	Pilchuck - Puyallup

Generally clayey soils formed in materials mixed with residuum-colluvium from sedimentary bedrock on foothills and uplands.

8	Felida - Dollar
9	Vader - Knappa

Generally silty or sandy soils formed in wind deposited or wind worked sediments on hilly uplands.

10	Goble - Cascade

Generally silty soils formed in materials mixed with rocky residuum-colluvium from basic rock types on plateaus, canyons and mountains.

11	Germany - Astoria
12	Olympic - Melbourne
13	Germany - Olympic
14	Olympic - Cispus
15	Rockland

Generally sandy soils formed in materials mixed with volcanic ash or pumice on terraces, foothills, plateaus and mountains.

16	Dominantly Dystrandepts
17	Bear Prairie-Loper
18	Cinebar - Cispus
19	Dominantly Cryandepts

* *Symbols are non-conotative and consistent only within each subregion. To compare delineations from one subregion to another refer to the name of the Soil Association.*

NOTE: The Soil Association name may include a series that does not fit the Soil Associations Group description. The Soil Association name is based on dominant series. The dominant of five series may be only 30 percent of the Soil Association. Thus a clayey textured soil series may be included in a group accurately described as generally silty and sandy in texture.

COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

SOIL ASSOCIATIONS

LOWER COLUMBIA, SUBREGION 8

FIGURE 35

Table 174 - Characteristics and Qualities of Representative Soils, Subregio

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage 3/ of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile
Very deep soils with loamy and fine-loamy subsoil on nearly level slopes.	1	20-100	45-90	120-180	Forest land 4/ Cropland (root crops, potatoes, sweet corn, green peas, pasture and hay) - 50% irrigated	Cumulic Ultic Haploxerolls	Fine-silty, mixed, mesic	Chehalis	40	Bottom-lands	Alluvium	Silty clay loam	Silty clay loam	None	--	60"+
						Cumulic Ultic Haploxerolls	Coarse-silty, mixed, mesic	Cloquato	40	Bottom-land	Alluvium	Silt loam	Silt loam	None	--	60"+
	2	20-200	45-60	180-210	Forest land 4/ Cropland (hay, pasture, silage, mint, specialty crops, and cereals)-25% irrigated	Fluventic Haploxerolls	Coarse-loamy, mixed, mesic	Newberg	30	Flood plains	Alluvium	Sandy loam	Sandy loam	Gravel	0-15 in profile	60"+
						Dystric Fluventic Xerochrepts	Coarse-silty, mixed, mesic	Cloto	25	Flood plains	Alluvium	Silt loam	Silt loam	None	--	60"+
						Fluventic Haplaquepts	Fine, mixed, non-acid, mesic	Caples	15	Flood plains	Alluvium	Silt loam or silty clay loam	Silty clay loam	None	--	60"+
	3	20-200	40-50	180-210	Forest land Cropland (hay, pasture, silage, mint, specialty crops, and cereals)-20% irrigated	Fluventic Haplaquolls (Typic)	Fine-silty, mixed, non-calcareous, mesic	Sauvie	30	Flood plains	Alluvium	Silty clay loam	Silty clay loam	None	--	60"+
						Typic Xeropsamments	Mixed, mesic	Pilchuck	10	Flood plains	Alluvium	Loamy fine sand	Sand	None	--	60"+
						--	--	Peat	10	Flood plains	Organic materials	Peat	Peat	None	--	20-30" ov water tabl
						Fluventic Haploxerolls	Coarse-loamy, mixed, mesic	Newberg	5	Flood plains	Alluvium	Sandy loam	Sandy loam	Gravel	0-15 in profile	60"+

Table 174 - Characteristics and Qualities of Representative Soils, Subregion 8[1]

.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated[6]	Major Soil Problems	Suitable Land Treatment and Structures
	Bottom-lands	Alluvium	Silty clay loam	Silty clay loam	None	--	60"+	Moderate	Moderately slow	Good	High	I IIw	I IIw	Wetness; flood in some areas	Forest land mgmt;drainage;flood protection; irrigation mgmt;residue mgmt; cropping sequence
	Bottom-land	Alluvium	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	I IIw	I IIw	Wetness; floods in some areas	Forest land mgmt;drainage;flood protection; irrigation mgmt;residue mgmt; cropping sequence
	Flood plains	Alluvium	Sandy loam	Sandy loam	Gravel	0-15 in profile	60"+	Rapid	Rapid	Somewhat excessive	Medium	IIw	IIw	Flooding	Forest land mgmt; flood protection; residue mgmt; winter cover; irrigation management
	Flood plains	Alluvium	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	I	I	Floods in some places	Forest land mgmt; flood protection; residue mgmt; cropping sequence; irrigation management
	Flood plains	Alluvium	Silt loam or silty clay loam	Silty clay loam	None	--	60"+	Slow	Slow	Somewhat poor and poor	High	IIw	IIw	Wetness	Forest land mgmt;drainage; residue mgmt;cropping sequence; irrigation management
0	Flood plains	Alluvium	Silty clay loam	Silty clay loam	None	--	60"+	Moderately slow	Slow	Moderately good and somewhat poor	High	IIw	IIw	Floods; seasonal high water table	Forest land mgmt;drainage; flood protection; diking; residue mgmt; cropping sequence; irrigation management
0	Flood plains	Alluvium	Loamy fine sand	Sand	None	--	60"+	Rapid	Very rapid	Somewhat excessive	Low	VIw	--	Floods; sandy profile	Forest land mgmt; flood protection
0	Flood plains	Organic materials	Peat	Peat	None	--	20-30" over water table	Moderate to very slow	Moderate to impervious	Very poor	High	IIIw	IIIw	High water table; acid soil; organic soil	Drainage; diking;pumping; soil amendments; irrigation management
5	Flood plains	Alluvium	Sandy loam	Sandy loam	Gravel	0-15 in profile	60"+	Rapid	Rapid	Somewhat excessive	Medium	IIw	IIw	Flooding	Forest land mgmt; flood protection; residue mgmt; winter cover; irrigation management

2

Soil Association: Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth
Moderately deep to very deep soils with gravelly, loamy subsoils on nearly level slopes.	4	100-500	40-50	180-210	Forest land Cropland (hay, pasture, and silage)-20% irrigated	Cumulic Haploxerolls	Loamy-skeletal, mixed, mesic	Lauren	40	Terraces	Alluvium	Gravelly loam	Very gravelly loam	Gravel	20-35 in top 10"; 35-80 below	60"+
						Umbric Vitrandepts	Ashy over sandy or sandy-skeletal, mixed, mesic	Sifton	15	Terraces	Alluvium	Gravelly loam	Very gravelly loamy sand or sand	Gravel and sand	20-35 in top 10"; 35-80 below	20-30" over gravel & sand
	5	200-800	50-60	150-180	Forest land[4] Cropland (pasture, hay and silage) - 5% irrigated	Typic Vitrandepts	Ashy, mesic	Toutle	30	Flood plains & terraces	Alluvium (pumicy & sandy)	Loamy sand	Loamy sand to very fine sandy loam (stratified)	Gravel	20-35 below 36-60"+	36-60"+ over gravelly sand
						Ultic Haploxeralfs	Fine-loamy, mixed, mesic	Kalama	30	Terraces	Alluvium	Gravelly loam	Gravelly clay loam	Gravel	20-35 in profile	60"+
Very deep acid soils with loamy subsoils on nearly level slopes.	6	20-1,000	60-80	150-180	Forest land[4] Cropland (silage and pasture) - 10% irrigated	Fluventic Haplumbrepts	Fine-silty, mixed, mesic	Nehalem	40	Flood plains	Alluvium	Silt loam	Silt loam or silty clay loam	None	--	60"+
						Fluventic Humaquepts	Fine, mixed, acid, mesic	Brenner	10	Flood plains	Basic igneous rock and sedimentary rock	Silt loam	Silty clay loam or silty clay	None	--	30-42" over clayey material
						Pachic Haplumbrepts	Fine-silty, mixed, mesic	Knappa	10	Terraces	Alluvium	Silt loam	Silty clay loam	None	--	60"+

Table 174 - Continued

Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass[6]: Dryland	Range of: Major Capability Subclass[6]: Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
	Soil Characterists						Soil Qualities and Interpretations							
Terraces	Alluvium	Gravelly loam	Very gravelly loam	Gravel	20-35 in top 10"; 35-80 below	60"+	Moderate	Very rapid	Somewhat excessive	Low	IIIs	IIIs	Gravelly profile	Forest land mgmt; irrigation mgmt.
Terraces	Alluvium	Gravelly loam	Very gravelly loamy sand or sand	Gravel and sand	20-35 in top 10"; 35-80 below	20-30" over gravel & sand	Rapid	Very rapid	Somewhat excessive	Low	IVs	IVs	Moderately deep over gravel and sand; gravelly and sandy profile; acid soil	Forest land mgmt; irrigation mgmt; soil amendments
Flood plains & terraces	Alluvium (pumicy & sandy)	Loamy sand	Loamy sand to very fine sandy loam (stratified)	Gravel	20-35 below 36-60"+	36-60"+ over gravelly sand	Rapid	Very rapid	Excessive	Low	IVs VIs	IVs	Pumicy and sandy profile	Forest land mgmt; irrigation mgmt.
Terraces	Alluvium	Gravelly loam	Gravelly clay loam	Gravel	20-35 in profile	60"+	Slow and very slow	Slow and very slow	Moderately good	Medium	IVe VIe VIIe	IVe	Erosion; gravelly profile	Forest land mgmt; irrigation mgmt.
Flood plains	Alluvium	Silt loam	Silt loam or silty clay loam	None	--	60"+	Moderate	Moderate	Good	High	IIw	IIw	Floods; acid soil	Forest land mgmt; flood protection; soil amendments; irrigation mgmt.
Flood plains	Basic igneous rock and sedimentary rock	Silt loam	Silty clay loam or silty clay	None	--	30-42" over clayey material	Slow	Very slow	Poor	High	IIIw	IIIw	High water table; clay subsoil; acid soil	Forest land mgmt; drainage; soil amendments; irrigation management
Terraces	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderate	Moderate	Good	High	IIIs VIe VIIe	IIIs	Erosion; acid soil	Forest land mgmt; soil amendments; irrigation management

2

Table 174 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze Free Season	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Parent Material	Soil Characteristics: Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth
	7	100-800	40-80	50-150	Forest land[4/]	Typic Xeropsamments	Mixed, mesic	Pilchuck	35	Flood plains	Alluvium	Loamy fine sand	Sand	None	--	60"+
					Cropland (hay, silage, and pasture)-10% irrigated	Fluventic Haploxerolls	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Puyallup	25	Terraces	Alluvium	Fine sandy loam or loam	Fine sandy loam over loamy sand	Gravel	20-35 below 40"	60"+
						Mollic Vitrandepts	Ashy, mesic	Mossyrock	10	Terraces	Alluvium (mostly pumice and ash)	Silt loam	Silt loam	None	--	60"+
Deep and very deep soils with fine-loamy subsoils on gentle to moderate slopes.	8	20-1,500	35-70	140-170	Forest land	Typic *Argixerolls*	Fine-silty, *mixed, mesic*	Felida	60	Terraces	Alluvium	Silt loam	Silt *loam*	None	--	60"+
					Cropland (cereals, pasture and hay) - 5% irrigated	Typic Fragiumbrepts	Fine-loamy, mixed, mesic	Dollar	20	Terraces	Alluvium	Loam	Loam	None	--	60"+
						Xeric Haplohumults	Clayey, mixed, mesic	Olympic	10	Uplands & mountain slopes	Basic igneous rock	Clay loam	Clay loam or silty clay loam	None	--	40-72"+ over bedrock
	9	50-1,600	40-60	50-150	Forest land[4/]	Dystric Xerochrepts	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Vader	40	Uplands (ridgetops and side slopes)	Sedimentary rock (sandstone)	Loam	Loam	None	--	30-72"+ over bedrock
					Cropland (pasture, hay, silage, and cereals) - dryland	Pachic Haplumbrepts	Fine-silty, mixed, mesic	Knappa	30	Terraces	Alluvium	Silt loam	Silty clay loam	None	--	60"+
						Andic Haplumbrepts	Fine, mixed, mesic	Astoria	20	Mountainous uplands	Sedimentary rock (siltstone or shale)	Silt loam	Silty clay	None	--	40"+ over bedrock

Table 174 - Continued

Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Soil Characteristics: Coarse Fragments: Kind	Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass 6/: Dryland	Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
Flood plains	Alluvium	Loamy fine sand	Sand	None	--	60"+	Rapid	Very rapid	Somewhat excessive	Low	VIw	--	Floods; sandy profile	Forest land mgmt; flood protection
Terraces	Alluvium	Fine sandy loam or loam	Fine sandy loam over loamy sand	Gravel	20-35 below 40"	60"+	Moderately rapid	Very rapid	Good	Low	IIs	IIs	Sandy profile	Forest land mgmt; irrigation mgmt.
Terraces	Alluvium (mostly pumice and ash)	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IIIs	IIIs	Pumice and ash soil	Forest land mgmt; soil amendments; irrigation management
Terraces	Alluvium	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	I, IIe, IIIe, IVe VIe, VIIe	I, IIe IIIe IVe	Erosion	Forest land mgmt; residue mgmt; cropping sequence; irrigation mgmt.
Terraces	Alluvium	Loam	Loam	None	--	60"+	Moderate	Moderately slow	Good	High	IIIs IVe VIe VIIe	IIIs IVe	Erosion; weak fragipan; acid soil	Forest land mgmt; soil amendments; residue mgmt; cropping sequence; irrigation management
Uplands & mountain slopes	Basic igneous rock	Clay loam	Clay loam or silty clay loam	None	--	40-72"+ over bedrock	Moderately slow	Impervious	Good	Medium and high	IIIe IVe, VIe VIIe	--	Erosion; acid soil	Forest land mgmt; soil amendments; residue mgmt; cropping sequence
Uplands (ridgetops and side slopes)	Sedimentary rock (sandstone)	Loam	Loam	None	--	30-72"+ over bedrock	Moderately rapid	Impervious	Somewhat excessive	Low to high	VIe VIIe	--	Erosion; moderately deep over bedrock in places; acid soil	Forest land management
Terraces	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderate	Moderate	Good	High	IIIs, VIe VIIe	--	Erosion; acid soil	Forest land mgmt; soil amendments
Mountainous uplands	Sedimentary rock (siltstone or shale)	Silt loam	Silty clay	None	--	40"+ over bedrock	Moderate	Slow to impervious	Good	Medium and high	VIe VIIe	--	Erosion; moderately deep over bedrock in places; acid soil	Forest land mgmt; restrict logging during prolonged wet periods

2

Soil Groups	Soil Association: Map Sym.	Soil Association: Elevation Feet	Soil Association: Precip. Inches	Soil Association: Freeze free Season Days	Soil Association: Major land use	Classification: Great Group or Subgroup	Classification: Family	Classification: Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Soil Characteristics: Texture Surface Soil	Soil Characteristics: Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth
Moderately deep to very deep soils with silty profiles on gentle to steep slopes.	10	200-1,800	45-75	180-200	Forest land[4/] Cropland (pasture and hay) - dryland	Andic Fragiumbrepts	Fine-silty, mixed, mesic	Goble	55	Uplands (ridgetops and side slopes)	Loess	Silt loam	Silty clay loam	None	--	30-40" over fragipan
						Aquic Fragiumbrepts	Fine-silty, mixed, mesic	Cascade	35	Uplands (ridgetops and side slopes)	Loess	Silt loam	Silt loam	None	--	20-40" over fragipan
						Ultic Haploxeralfs	Fine-silty, mixed, mesic	Laurelwood	5	Uplands (ridgetops and side slopes)	Loess	Silt loam	Silty clay loam	None	--	60"+
						Humic Fragiaquepts	Fine, mixed, mesic	Delena	2	Uplands (swales)	Loess	Silt loam	Silty clay	None	--	20-30" over fragipan
Deep to very deep soils with loamy and clayey subsoils on strong to very steep slopes.	11	20-2,500	70-120	50-150	Forest land[4/] Cropland (pasture, silage and cereals)	Pachic Xerumbrepts	Coarse-silty, mixed, mesic	Germany	35	Uplands	Loess and basic igneous rock	Silt loam	Silt loam	None	--	60"+
						Andic Haplumbrepts	Fine, mixed, mesic	Astoria	30	Mountainous uplands	Sedimentary rock (siltstone or shale)	Silt loam	Silty clay	None	--	40"+ over bedrock
						Xeric Haplohumults	Clayey, mixed, mesic	Olympic	20	Uplands & mountain slopes	Basic igneous rock	Clay loam	Clay loam or silty clay loam	None	--	40-72"+ over bedrock
						Xeric Haplohumults	Clayey, kaolinitic, mesic	Melbourne	10	Uplands	Sedimentary rock (shale and sandstone)	Silty clay loam	Silty clay	None	--	60"+

Table 174 - Continued

tion (h) scape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Soil Qualities and Interpretations: Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Range of: Major Capability Subclass: Irrigated[6]	Major Soil Problems	Suitable Land Treatment and Structures
nds getops side es)	Loess	Silt loam	Silty clay loam	None	--	30-40" over fragipan	Moderate	Slow	Good and moderately good	High	IIIe,IVe VIe VIIe	--	Erosion	Forest land mgmt; cross-slope operations; residue mgmt; cropping sequence
nds getops side es)	Loess	Silt loam	Silt loam	None	--	20-40" over fragipan	Moderate	Very slow to impervious	Somewhat poor	High	IIIe IVe VIe VIIe	--	Erosion; wetness	Forest land mgmt; cross-slope operations; residue mgmt; cropping sequence; drainage
nds getops side es)	Loess	Silt loam	Silty clay loam	None	--	60"+	Moderate	Moderate	Good	High	IIe,IIIe IVe,VIe VIIe	--	Erosion	Forest land mgmt; cross-slope operations; residue mgmt; cropping sequence
nds es)	Loess	Silt loam	Silty clay	None	--	20-30" over fragipan	Moderate	Slow	Poor	High	IIIw	--	Wetness	Drainage; residue mgmt; cropping sequence; forest land management
nds	Loess and basic igneous rock	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IIIe,IVe VIe VIIe	--	Erosion; acid soil	Forest land mgmt; soil amendments; residue mgmt; cropping sequence
tain- uplands	Sediment-ary rock (siltstone or shale)	Silt loam	Silty clay	None	--	40"+ over bedrock	Moderate	Slow to impervious	Good	Medium and High	VIe VIIe	--	Erosion; moderately deep over bedrock in places; acid soil	Forest land management; restrict logging during prolonged wet periods
nds & tain s	Basic igneous rock	Clay loam	Clay loam or silty clay loam	None	--	40-72"+ over bedrock	Moderately slow	Impervious	Good	Medium and High	IIIe,IVe VIe VIIe	--	Erosion; acid soil	Forest land mgmt; soil amendments; residue mgmt; cropping sequence
nds	Sediment-ary rock (shale and sandstone)	Silty clay loam	Silty clay	None	--	60"+	Moderately slow	Impervious	Good	High	IVe,VIe VIIe	--	Erosion; acid soil	Forest land management

2

Table 174 - Continued

Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series 2/	Percentage 3/ of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth	
	12	1,000-3,000	60-90	50-150	Forest land 4/ Cropland (hay, pasture and silage)-mostly dryland	Xeric Haplohumults	Clayey, mixed, mesic	Olympic	40	Uplands & mountain slopes	Basic igneous rock	Clay loam	Clay loam or silty clay loam	None	--	40-72"+ over bedrock	
						Xeric Haplohumults	Clayey, kaolinitic, mesic	Melbourne	30	Uplands	Sedimentary rock (shale & sandstone)	Silty clay loam	Silty clay	None	--	60"+	
						Typic Glossudalfs	Fine, mixed, mesic	Sara	10	High terraces	Alluvium	Silt loam	Silty clay loam or silty clay	None	--	60"+	
						Typic Drystrochrepts	Fine, mixed, mesic	Melby	10	Uplands	Sedimentary rock	Silt loam	Silty clay	None	--	40-60"+ over bedrock	M
						Typic Haplohumults	Fine-loamy, mixed, mesic	Olyic	5	Uplands (ridgetops and steep slopes)	Basic igneous rock	Silt loam	Silty clay loam	None	--	40-60"+ over bedrock	M
	13	20-2,000	60-80	100-150	Forest land 4/	Pachic Xerumbrepts	Coarse-silty, mixed, mesic	Germany	40	Uplands	Loess and basic igneous rock	Silt loam	Silt loam	None	--	60"+	M
						Xeric Haplohumults	Clayey, mixed, mesic	Olympic	35	Uplands & mountain slopes	Basic igneous rock	Clay loam	Clay loam or silty clay	None	--	40-72"+ over bedrock	Ma s
						Ultic Haploxeralfs	Fine-silty, mixed, mesic	Olequa	20	Terraces	Alluvium	Silt loam	Silt loam or silty clay loam	None	--	60"+	Mo mo sl

Table 174 - Continued

Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Range of: Major Capability Subclass: Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
	Soil Characteristics						**Soil Qualities and Interpretations**							
Uplands & mountain slopes	Basic igneous rock	Clay loam	Clay loam or silty clay loam	None	--	40-72"+ over bedrock	Moderately slow	Impervious	Good	Medium and high	IIIe,IVe VIe,VIIe	--	Erosion; acid soil	Forest land mgmt; soil amendments
Uplands	Sedimentary rock (shale & sandstone)	Silty clay loam	Silty clay	None	--	60"+	Moderately slow	Impervious	Good	High	IVe,VIe VIIe	--	Erosion; acid soil	Forest land mgmt; soil amendments
High terraces	Alluvium	Silt loam	Silty clay loam or silty clay	None	--	60"+	Moderately slow	Very slow	Moderately good	High	IIIe VIIe	--	Erosion; acid soil	Forest land mgmt; soil amendments; residue mgmt; cropping sequence
Uplands	Sedimentary rock	Silt loam	Silty clay	None	--	40-60"+ over bedrock	Moderately slow	Impervious	Good	Medium and high	IIIe,IVe VIe,VIIe	--	Erosion; acid soil	Forest land management
Uplands (ridgetops and steep slopes)	Basic igneous rock	Silt loam	Silty clay loam	None	--	40-60"+ over bedrock	Moderate	Impervious	Good	Medium and high	IIe,IIIe IVe,VIe VIIe	--	Erosion; acid soil	Forest land management
Uplands	Loess and basic igneous rock	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IIIe,VIe VIIe	--	Erosion; acid soil	Forest land management
Uplands & mountain slopes	Basic igneous rock	Clay loam	Clay loam or silty clay	None	--	40-72"+ over bedrock	Moderately slow	Impervious	Good	Medium and high	IIIe,IVe VIe,VIIe	--	Erosion; acid soil	Forest land management
Terraces	Alluvium	Silt loam	Silt loam or silty clay loam	None	--	60"+	Moderate and moderately slow	Moderate and moderately slow	Good and moderately good	High	IIs,IIIe IVe,VIe VIIe	--	Erosion; acid soil	Forest land management

2

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Per[...]
	14	200-3,000	60-90	50-150	Forest land[4/] Cropland (hay, pasture and silage) - 2% irrigated	Xeric Haplohumults	Clayey, mixed, mesic	Olympic	40	Uplands & mountain slopes)	Basic igneous rock	Clay loam	Clay loam or silty clay loam	None	--	40-72"+ over bedrock	Mod[...] slo[...]
						Umbric Vitrandepts	Cindery, mesic	Cispus	30	Terraces & mountain slopes	Pumice,ash and some basic igneous rock	Gravelly sandy loam	Gravelly loamy sand	Gravel	20-35 in profile	60"+	Rap[...]
						Typic Argiudolls	Fine, mixed, mesic	St. Martin	15	Uplands & mountain slopes	Basic igneous rock	Clay loam	Clay loam or clay	None	--	60"+	Slo[...]
Miscellaneous shallow, rocky soils on strong to extremely steep slopes.	15	4,000-14,500	150-240	0-30	Other land Forest land[4/]	Rockland	--	--	100	Uplands (steep mountains)	Igneous & sedimentary rock	--	--	--	--	10-60"+ over bedrock	Mod[...] imp[...]
Moderately deep to very deep, ashy soils with loamy and sandy subsoils on gentle to steep slopes.	16	500-5,000	40-100	50-120	Forest land[4/]	Dystrandepts plus Haplohumults and Haplumbrepts	Ashy and loamy-skeletal, mixed, mesic	--	100	Uplands (mountainous)	Volcanic ash, basic igneous rock and glacial outwash	--	--	--	--	60"+ over volcanic ash, sand bedrock	Mod[...]
	17	50-2,000	60-90	100-150	Forest land[4/]	Typic Dystrandepts	Ashy, mesic	Bear Prairie	40	Terraces	Volcanic ash over basic igneous rock	Silt loam	Silt loam	None	--	60"+	Mod[...]
						Dystric Xerochrepts	Coarse-loamy, mixed, mesic	Loper	30	Mountain slopes and ridges	Basic igneous rock	Cobbly silt loam	Gravelly loam	Gravel and cobbles	20-35 in profile	40"+ over bedrock	Mod[...]
						--	--	Rockland[5/]	20	Uplands	Basic igneous and sedimentary rock	--	--	--	--	0-10" over bedrock	--

Table 174 - Continued

Per-cen... ssn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass 6/ Dryland	Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
40	Uplands & mountain slopes)	Basic igneous rock	Clay loam	Clay loam or silty clay loam	None	--	40-72"+ over bedrock	Moderately slow	Impervious	Good	Medium and high	IIIe,IVe VIe,VIIe	IIIe IVe	Erosion; acid soil	Forest land management; irrigation management
50	Terraces & mountain slopes	Pumice,ash and some basic igneous rock	Gravelly sandy loam	Gravelly loamy sand	Gravel	20-35 in profile	60"+	Rapid	Rapid	Somewhat excessive	Low	VIs	--	Gravelly profile	Forest land management
15	Uplands & mountain slopes	Basic igneous rock	Clay loam	Clay loam or clay	None	--	60"+	Slow	Impervious	Moderately good	High	IVe,VIe VIIe	IVe	Erosion	Forest land management; irrigation management
00	Uplands (steep mountains)	Igneous & sedimentary rock	--	--	--	--	10-60"+ over bedrock	Moderate to impervious	--	Good to poor	Low	VIIIs VIIIe	--	Shallow over bedrock; steep slopes	Protection
0	Uplands (mountainous)	Volcanic ash, basic igneous rock and glacial outwash	--	--	--	--	60"+ over volcanic ash, sand bedrock	Moderate	--	Good	Medium	VIe VIs	--	Erosion; acid soil; ashy soil	Continued forest land management; limited wet weather logging.
0	Terraces	Volcanic ash over basic igneous rock	Silt loam	Silt loam	None	--	60"+	Moderate	Impervious	Good	High	IIIs IVe	--	Erosion; acid soil	Forest land management
0	Mountain slopes and ridges	Basic igneous rock	Cobbly silt loam	Gravelly loam	Gravel and cobbles	20-35 in profile	40"+ over bedrock	Moderate	Impervious	Good	Low and medium	VIe VIIe	--	Erosion; cobbly and gravelly profile; acid soil	Forest land management
0	Uplands	Basic igneous and sedimentary rock	--	--	--	--	0-10" over bedrock	--	Impervious	Good	Low	VIIIs	--	Shallow over bedrock	--

2

Table 174 - Continued

Soil Groups	Soil Association: Map Sym.	Soil Association: Elevation Feet	Soil Association: Precip. Inches	Soil Association: Freeze free Season Days	Soil Association: Major land use	Classification: Great Group or Subgroup	Classification: Family	Classification: Series 2/	Percentage 3/ of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Soil Characteristics: Texture Surface Soil	Soil Characteristics: Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth
	18	2,000-5,000	60-140	120-170	Forest land 4/ Cropland (hay, pasture and silage)-some irrigated	Typic Dystrandepts	Ashy, mesic	Cinebar	40	Uplands (rolling & mountainous)	Volcanic ash over basic igneous rock	Silt loam	Silt loam	None	--	60"+
						Umbric Vitrandepts	Cindery, mesic	Cispus	30	Terraces & mountain slopes	Pumice, ash & some basic igneous rock	Gravelly sandy loam	Gravelly loamy sand	Gravel	20-35 in profile	60"+
						Xeric Haplohumults	Clayey, mixed, mesic	Olympic	20	Uplands & mountain slopes	Basic igneous rock	Clay loam	Clay loam or silty clay loam	None	--	40-72"+ over bedrock
Miscellaneous, shallow, rocky and ashy soils with cold winters on strong to extremely steep slopes.	19	1,800-9,000	70-180	30-100	Other land Forest land 4/	Cryandepts plus Cryorthods and Haplumbrepts	Ashy and cindery over loamy, mixed	--	100	Uplands & mountainous slopes	Pumice, igneous & sedimentary rock	--	--	--	--	0-10" over bedrock

1/ Based on data summarized during 1966.
2/ Only soil series names that have a status as reserved, tentative, or established are listed.
3/ Differences of total percentage in each soil association from 100 percent are inclusions of other soils and land types.
4/ For the upland forest soils, the above characteristics and qualities have been extended from a limited amount of survey data. Additional data and land use interpretations for forest soils are available in the Forest Land section of Appendix VIII, Land Measures and Watershed Protection. These areas include National Forest and adjacent non-Federal forest lands.
5/ Miscellaneous land types.
6/ Presently irrigated cropland.

SOURCE: National Cooperative Soil Survey.

Table 174 - Continued

Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
Uplands (rolling & mountainous)	Volcanic ash over basic igneous rock	Silt loam	Silt loam	None	--	60"+	Moderate	Impervious	Good	High	IIe, IIIe VIe VIIe	IIe IIIe	Erosion; ashy profile; acid soil	Forest land management; soil amendments; irrigation management
Terraces & mountain slopes	Pumice, ash & some basic igneous rock	Gravelly sandy loam	Gravelly loamy sand	Gravel	20-35 in profile	60"+	Rapid	Rapid	Somewhat excessive	Low	VIs	--	Gravelly profile	Forest land management
Uplands & mountain slopes	Basic igneous rock	Clay loam	Clay loam or silty clay loam	None	--	40-72"+ over bedrock	Moderately slow	Impervious	Good	Medium and high	IIIe IVe VIe VIIe	--	Erosion; acid soil	Forest land management; soil amendments
Uplands & mountainous slopes	Pumice, igneous & sedimentary rock	--	--	--	--	0-10" over bedrock	Moderately rapid	--	Good	Low	VIe	--	Erosion; with improper land use	Continued forest land management and protection

and land types.
amount of survey data.
of Appendix VIII, Land
lands.

2

Very rapid: Over 10 inches per hour.
Rapid: 5 to 10 inches per hour.
Moderately rapid: 2.50 to 5 inches per hour.
Moderate: 0.8 to 2.5 inches per hour.
Moderately slow: 0.2 to 0.8 inches per hour.
Slow: 0.05 to 0.2 inches per hour.
Very slow: Less than 0.05 inches per hour.

Terms listed for total available water-holding capacity are:

Low: Less than 6 inches in profile.
Medium: 6 to 10 inches.
High: More than 10 inches in profile.

The irrigated capability subclasses are an interpretation of limitations and hazards of using only presently irrigated lands. Many areas not presently irrigated may be potentially irrigable but are not included in this classification.

A dash indicates that a column does not apply or there is insufficient data to complete it. Because of its location west of the Cascade Range, the soils in Subregion 8 are formed under contrasting climatic, elevation, vegetative, and parent material relationship from the soils in subregions east of the Cascades. Table 174 shows the elevation, rainfall, growing season, and cover differences of land on the Pacific slope of the Cascades. Table 175 shows the estimated acreage and proportionate extent of the soil association by states.

Table 175 - Soil Association Acreage by States, Subregion 8, 1966

Soil Association: Map Symbol	Soil Association: Name	Washington	Oregon (1,000 acres)	Total	Percent
1	Chehalis-Cloquato	8.0	-	8.0	0.3
2	Newberg-Clato	45.0	-	45.0	1.4
3	Sauvie-Pilchuck	115.0	37.6	152.6	4.8
4	Lauren-Sifton	30.0	-	30.0	0.9
5	Toutle-Kalama	22.0	-	22.0	0.7
6	Nehalem-Brenner	20.0	-	20.0	0.6
7	Pilchuck-Puyallup	125.0	-	125.0	3.9
8	Felida-Dollar	140.0	-	140.0	4.4
9	Vader-Knappa	90.0	-	90.0	2.8
10	Goble-Cascade	-	105.0	105.0	3.3
11	Germany-Astoria	150.0	-	150.0	4.7
12	Olympic-Melbourne	125.0	20.0	145.0	4.5
13	Germany-Olympic	115.0	-	115.0	3.6
14	Olympic-Cispus	260.0	-	260.0	8.2
15	Rockland	110.0	-	110.0	3.4
16	Dominantly Dystrandepts	160.0	-	160.0	5.0
17	Bear Prairie-Loper	45.0	-	45.0	1.4
18	Cinebar-Cispus	570.0	-	570.0	17.9
19	Dominantly Cryandepts	900.0	-	900.0	28.2
	Total Land Area	3,030.0	162.6	3,192.6	100.0

Source: National Cooperative Soil Survey.

Tables 174 and 175 also show characteristics, qualities, acreage, and extent of each soil association, and reflect some interesting contrasts. For example, almost half of the soil associations and about 30 percent of the land area have little or no coarse fragments in the soil profile. About 60 percent of the soil area is influenced by volcanic ash or pumice.

Interpretations and Evaluation

Table 176 relates the land capability classes to the Land Capability Map, figure 3. It must be realized that the Land Capability Map is highly generalized and a specific capability class on table 176 may not be shown. To determine the land capability of any particular area refer to the soil association symbols listed in the second column of the table and then locate the area of that symbol on the Soil Association Map, figure 35. Table 176 also shows the acreage and extent of the dominant land capability class for practical segments of the landscape.

Table 176 - Summary and Distribution of Land Capability Classes, Subregion 8, 1966

Land Capability Classes	Distribution by Soil Associations1/ Soil Association Map Symbols2/	1,000 Acres	Percent	Inventoried 1,000 Acres3/
Class I - Soils in Class I have no limitations or hazards. They are adopted to all uses with a minimum of conservation treatment other than standard conditioning ones.4/	-	-	-	11.6
Class II - Soils in Class II have few limitations or hazards. Simple conservation practices are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	1-2-6	73.0	2.3	217.0
Class III - Soils in Class III have more limitations and hazards than those in Class II. They require more difficult or complex conservation practices when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	3-8	292.6	9.2	434.7
Class IV - Soils in Class IV have greater limitations and hazards than Class III. Still more difficult or complex measures are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	4-9-10-11-13	490.0	15.3	466.7
Class V - Soils in Class V have more limitations than Class IV. They are generally unsuited for cultivation, but are well suited for grazing and forestry use. They require good management practices.4/	-	-	-	-
Class VI - Soils in Class VI have severe limitations or hazards that make them generally unsuited for cultivation. They are suited largely to pasture, range, woodland or wildlife.	5-7-12-14 16-17-18-19	2,227.0	69.8	1,860.5
Class VII - Soils in Class VII have very severe limitations and hazards that make them generally unsuited for cultivation. They are suited to grazing, noncommercial, woodland or wildlife.	-	-	-	126.5
Class VIII - Soils and land forms in Class VIII have limitations and hazards that prevent their use for cultivated crops, pasture, range or woodland. They may be used for recreation, wildlife or water supply.	15	110.0	3.4	75.6
Total Land		3,192.6	100.0	3,192.6

1/ Class I and 10 percent of other capability classes may be included in areas of Class II. Up to 25 percent of other capability classes may be included in Classes III and IV. Class V and up to 40 percent of other capability classes may be included in Classes VI, VII, and VIII. In areas of rainfall less than 12 inches, large areas of Class VI can be potential Classes I through IV where irrigation water is available.
2/ Refer to the Subregional Soil Association Map, figure 35.
3/ Taken from table 8.
4/ Capability Classes I and V are distributed in small segregated areas over segments of the landscape. Many small areas could not be delineated on the map. This added detail, although still generalized, is commensurate with the subregional level of generalization.
Source: National Cooperative Soil Survey and U.S.D.A. Conservation Needs Inventory adjusted.

Classified on table 177 is the dominant water storage capacity for each soil association in Subregion 8. Each class on the table relates to a similar class on the Water Storage Capacity, figure 4. To locate those areas having contrasting water storage capacity in the upper 5 feet of soil, refer to figure 4, to figure 35 (the subregional Soil Associations Map), and to the following table. The class letter symbol in the first column and the Soil Association Map numerical symbol listed in the second column may be used to locate those areas having contrasting water storage capacity. Complete utilization of this storage contributes toward more stable and sustained streamflow.

Table 177 - Water Storage Capacity of Soils Generalized to the Soil Associations, Subregion 8, 1966

Classes of Water Storage Capacity 1/	Soil Association Symbols	1,000 Acres	Percent
Class A - Water storage in the soil profile more than 20,000 acre-feet per township.	1-2-3-6-8	365.6	11.5
Class B - Water storage in the soil profile 10,000 to 20,000 acre-feet per township.	7-9-10-11 12-13	730.0	22.8
Class C - Water storage in the soil profile 5,000 to 10,000 acre-feet per township.	5-14-16 17-18-19	1,957.0	61.3
Class D - Water storage in the soil profile less than 5,000 acre-feet per township.	4-15	140.0	4.4
Total		3,192.6	100.0

1/ Measurement of the water storage capacity is limited to the upper 5 feet of soil or to bedrock.
Source: National Cooperative Soil Survey.

Cover and Land Use

The four major cover and land uses as defined in the glossary and explained in the introduction have been summarized by acreage and ownership on tables 178 through 180. The broad categories have been determined both on the basis of cover and use. Cropland is more specifically a use category. Forest land has more than 10 percent forest cover. Rangeland areas have broad range cover characteristics. Other land includes land specifically based on use, such as urban as well as that based specifically on cover characteristics such as rock and sand dune areas.

The four major categories have been generalized for presentation on figure 36. Since this information has been generalized, isolated areas of different cover and uses may occur within the broad patterns.

(Narrative continued on page 271)

Table 178 - Cover and Land Use by Ownership, Subregion 8, 1966

Ownership	Cropland	Forest Land	Rangeland (1,000 acres)	Other Land	Total
Department of Agriculture					
Forest Service	-	833.5	18.0	73.3	924.8
Other Agriculture	-	-	-	-	-
	-	833.5	18.0	73.3	924.8
Department of the Interior					
Bureau of Land Management[1/]	-	1.6	-	.2	1.8
Bureau of Indian Affairs[1/]	-	.8	-	.9	1.7
National Park Service	-	62.0	-	9.2	71.2
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	-	-	-	-	-
Other Interior	-	-	-	2.4	2.4
	-	64.4	-	12.7	77.1
Department of Defense	-	3.0	-	.1	3.1
Other Federal	-	-	-	.1	.1
Federal Subtotal	-	900.9	18.0	86.2	1,005.1
State	.4	250.0	3.0	48.8	302.2
County	-	5.0	-	2.9	7.9
Municipal	-	10.0	-	4.7	14.7
Public Total	.4	1,165.9	21.0	142.6	1,329.9
Private Total	200.7	1,499.1	46.9	116.0	1,862.7
Total Land Area	201.1	2,665.0	67.9	258.6	3,192.6

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.

Table 179 - Cover and Land Use by Ownership, ate of Oregon, Subregion 8, 1966

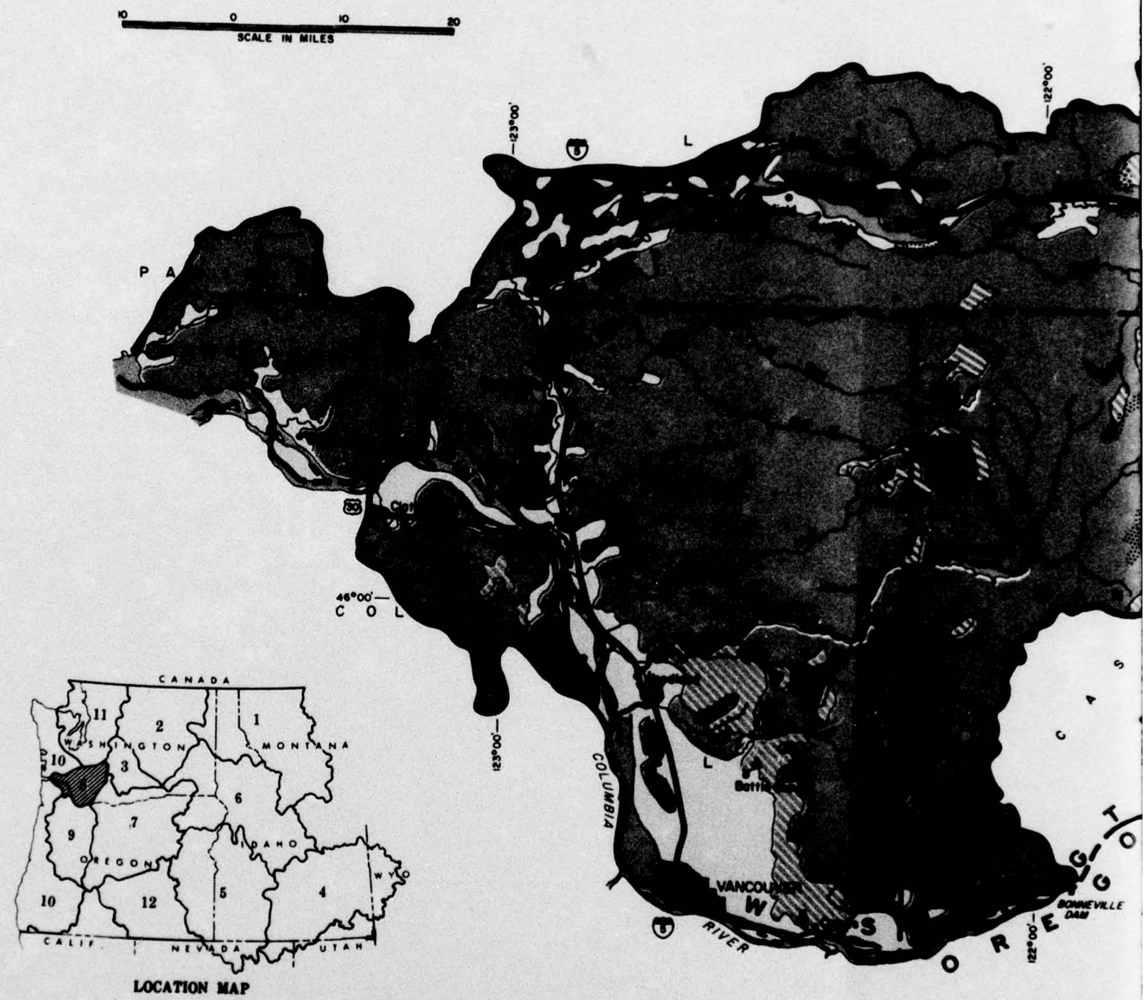
Ownership	Cropland	Forest Land	Rangeland (1,000 acres)	Other Land	Total
Department of Agriculture					
Forest Service	-	-	-	-	-
Other Agriculture	-	-	-	-	-
	-	-	-	-	-
Department of the Interior					
Bureau of Land Management	-	.6	-	-	.6
Bureau of Indian Affairs 1/	-	-	-	-	-
National Park Service	-	-	-	-	-
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	-	-	-	-	-
Other Interior	-	-	-	-	-
	-	.6	-	-	.6
Department of Defense	-	-	-	-	-
Other Federal	-	-	-	-	-
Federal Subtotal	-	.6	-	-	.6
State	-	2.0	-	4.0	6.0
County	-	-	-	.6	.6
Municipal	-	-	-	1.6	1.6
Public Total	-	2.6	-	6.2	8.8
Private Total	19.2	121.4	12.0	1.2	153.8
Total Land Area	19.2	124.0	12.0	7.4	162.6

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.

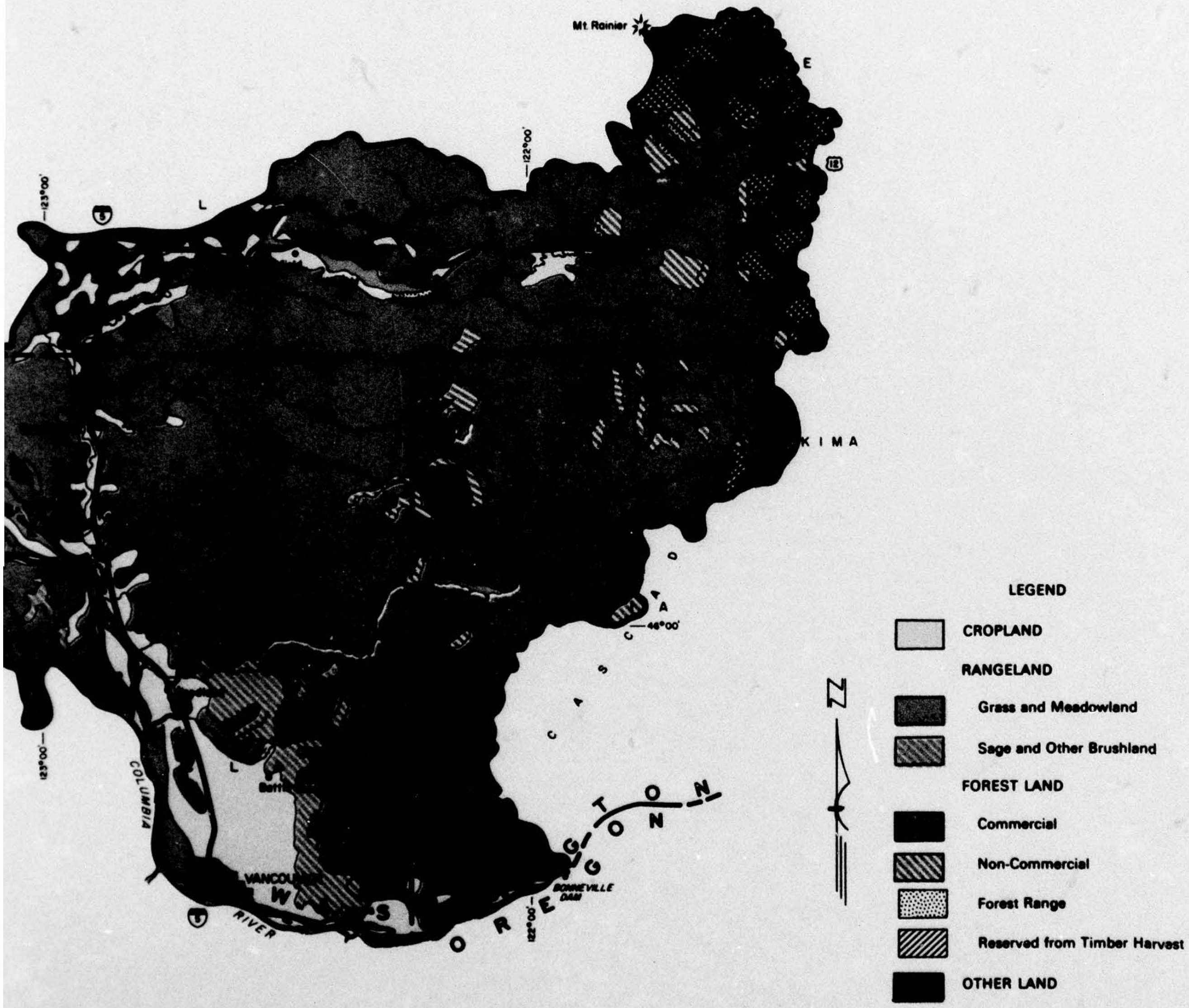
Table 180 - Cover and Land Use by Ownership, State of Washington, Subregion 8, 1966

Ownership	Cropland	Forest Land	Rangeland	Other Land	Total
			(1,000 acres)		
Department of Agriculture					
Forest Service	-	833.5	18.0	73.3	924.8
Other Agriculture	-	-	-	-	-
	-	833.5	18.0	73.3	924.8
Department of the Interior					
Bureau of Land Management	-	1.0	-	.2	1.2
Bureau of Indian Affairs1/	-	.8	-	.9	1.7
National Park Service	-	62.0	-	9.2	71.2
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	-	-	-	-	-
Other Interior	-	-	-	2.4	2.4
	-	63.8	-	12.7	76.5
Department of Defense	-	3.0	-	.1	3.1
Other Federal	-	-	-	.1	.1
Federal Subtotal	-	900.3	18.0	86.2	1,004.5
State	.4	248.0	3.0	44.8	296.2
County	-	5.0	-	2.3	7.3
Municipal	-	10.0	-	3.1	13.1
Public Total	.4	1,163.3	21.0	136.4	1,321.1
Private Total	181.5	1,377.7	34.9	114.8	1,708.9
Total Land Area	181.9	2,541.0	55.9	251.2	3,030.0

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.



LOCATION MAP



COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

GENERALIZED COVER AND LAND USE

LOWER COLUMBIA, SUBREGION 8

1968

FIGURE 36

2

Cropland

The annual rainfall of over 40 inches washes away many basic nutrients from the soil. Under natural conditions cane fruits, certain tree fruits, and nursery stock produce especially well. However, to successfully grow most grasses, cereals, legumes, roots, and tubers it is necessary first to adjust the base exchange complex in the soil by adding lime or other amendments, and then adjust the nutrient level with fertilizers to create a soil environment conducive to these crops. Generally the cropland receives sufficient natural moisture to grow the full range of adapted crops without irrigation. However, the timely use of irrigation permits more intensive management resulting in greater production and higher quality. The 17,300 acres of cropland presently irrigated are 8.6 percent of the total cropland. To satisfy the growing demand for specialty and row crops the amount of irrigation and intensity of management will probably increase. Table 181 lists the acreage of representative categories of crops and the extent of each group.

Table 181 - Cropland Acreage of Representative Categories of Crops by States, Subregion 8, 1966

Categories of Crops	Washington	Oregon	Total	Percent
		(1,000 acres)		
Dryland Cropland 1/				
Forage crops	164.0	14.2	178.2	88.7
Close grown field crops	-	1.5	1.5	.7
Specialty crops 3/	-	1.0	1.0	.5
Orchards and vineyards	2.1	1.0	3.1	1.5
Total dryland crops	166.1	17.7	183.8	91.4
Irrigated Cropland 1/				
Forage crops	10.3	1.1	11.4	5.7
Row crops 2/	3.0	.2	3.2	1.6
Specialty crops 3/	1.9	.2	2.1	1.0
Orchards and vineyards	.6	-	.6	.3
Total irrigated crops	15.8	1.5	17.3	8.6
Total cropland	181.9	19.2	201.1	100.0

1/ Does not include other land that is irrigated (table 188).
2/ Includes potatoes, beans, corn, etc.
3/ Includes mint, vegetable seed, and other special and inextensive crops.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Forest Land

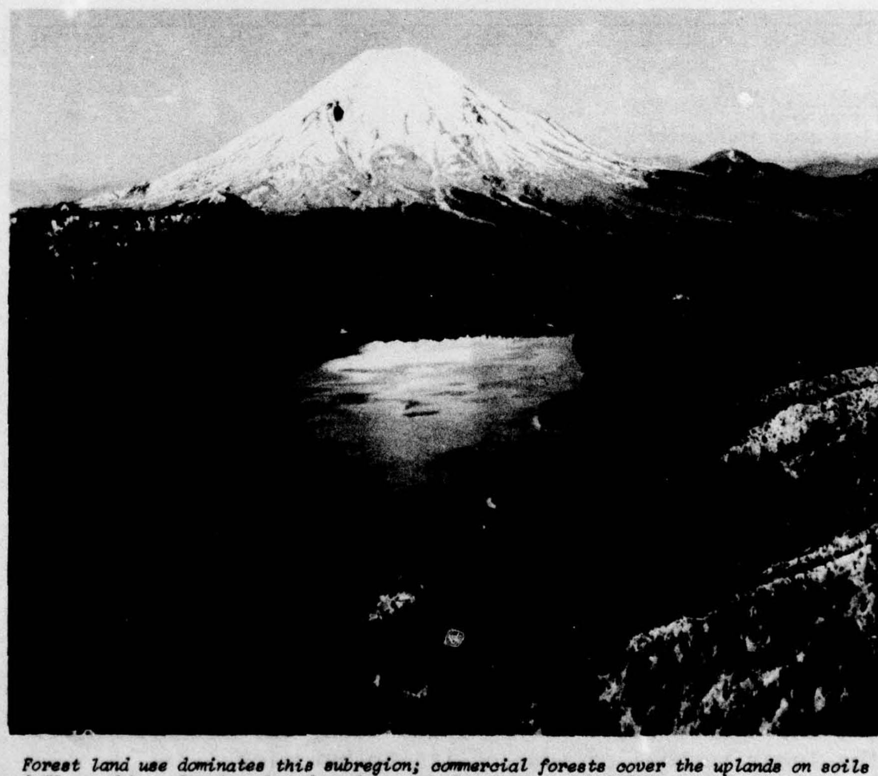
Forest land covers 2,665,000 acres, or 83 percent of the total land area in Subregion 8. Seventy-six percent of Oregon and 84 percent of Washington are forested. These forests cover all but the agricultural bottom lands along the Columbia River and the lower reaches of some of its tributaries.

Forty-four percent, or nearly 1.2 million acres, of the

forest land is publicly owned. Of this, 71 percent is national forest, 7 percent other small Federal holdings, and 12 percent owned by state and local governments. Fifty-six percent, or almost 1.5 million acres, is privately owned, much in large industrial tree farms (tables 182 through 184).

Timber Nearly 2.5 million acres are classed as commercial forest land, about 80 percent softwood. The major species is Douglas-fir. Other significant species include hemlock and true firs. Hardwoods make up the balance. The remaining 190,000 acres are noncommercial forest, two-fifths unproductive and three-fifths on lands reserved from cutting.

Sixty percent of the commercial forest area is in the sawtimber class. Thirteen percent is classed as pole timber and 24 percent saplings and seedlings, 3 percent is nonstocked. Only 65,000 acres of the commercial forest land are in the reserved category. The balance supports over 96.5 billion board feet of timber, supplying raw material for a forest products industry which furnishes 74 percent of the subregion's manufacturing employment.



Forest land use dominates this subregion; commercial forests cover the uplands on soils influenced by volcanic ash and pumice. Mt. St. Helens with Spirit Lake in the foreground. (U. S. Forest Service)

Table 182 - Forest Land Acreage by Generalized Type and Ownership, Subregion 8, 1966

Ownership	Commercial Forest Land	Noncommercial Forest Land: Productive Reserved	Noncommercial Forest Land: Unproductive Reserved	Noncommercial Forest Land: Unproductive	Total
	(1,000 acres)				
Forest Service	750.5	21.0	16.0	46.0	833.5
Bureau of Land Management	1.6	-	-	-	1.6
Bureau of Indian Affairs 1/	.8	-	-	-	.8
National Park Service	-	39.0	23.0	-	62.0
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	-	-	-	-	-
Department of Defense	3.0	-	-	-	3.0
Other Federal	-	-	-	-	-
Federal Subtotal	755.9	60.0	39.0	46.0	900.9
State	244.0	1.0	-	5.0	250.0
County	5.0	-	-	-	5.0
Municipal	4.0	4.0	1.0	1.0	10.0
Public Total	1,008.9	65.0	40.0	52.0	1,165.9
Private Total	1,464.6	-	-	34.5	1,499.1
Grand Total	2,473.5	65.0	40.0	86.5	2,665.0

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest Experiment Station.

Table 183 - Forest Land Acreage by Generalized Type and Ownership, State of Oregon, Subregion 8, 1966

Ownership	Commercial Forest Land	Noncommercial Forest Land: Productive Reserved	Noncommercial Forest Land: Unproductive Reserved	Noncommercial Forest Land: Unproductive	Total
	(1,000 acres)				
Forest Service	-	-	-	-	-
Bureau of Land Management	.6	-	-	-	.6
Bureau of Indian Affairs 1/	-	-	-	-	-
National Park Service	-	-	-	-	-
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	-	-	-	-	-
Department of Defense	-	-	-	-	-
Other Federal	-	-	-	-	-
Federal Subtotal	.6	-	-	-	.6
State	2.0	-	-	-	2.0
County	-	-	-	-	-
Municipal	-	-	-	-	-
Public Total	2.6	-	-	-	2.6
Private Total	119.4	-	-	2.0	121.4
Grand Total	122.0	-	-	2.0	124.0

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest Experiment Station.

Table 184 - Forest Land Acreage by Generalized Type and Ownership, State of Washington, Subregion 8, 1966

Ownership	Commercial Forest Land	Noncommercial Forest Land: Productive Reserved	Noncommercial Forest Land: Unproductive Reserved	Noncommercial Forest Land: Unproductive	Total
		(1,000 acres)			
Forest Service	750.5	21.0	16.0	46.0	833.5
Bureau of Land Management	1.0	-	-	-	1.0
Bureau of Indian Affairs[1/]	.8	-	-	-	.8
National Park Service	-	39.0	23.0	-	62.0
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	-	-	-	-	-
Department of Defense	3.0	-	-	-	3.0
Other Federal	-	-	-	-	-
Federal Subtotal	755.3	60.0	39.0	46.0	900.3
State	242.0	1.0	-	5.0	248.0
County	5.0	-	-	-	5.0
Municipal	4.0	4.0	1.0	1.0	10.0
Public Total	1,006.3	65.0	40.0	52.0	1,163.3
Private Total	1,345.2	-	-	32.5	1,377.7
Grand Total	2,351.5	65.0	40.0	84.5	2,541.0

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest Experiment Station.

Forest Range Forest range includes 106,000 acres all of which are classified as commercial forest land. This represents about 4 percent of the total forest land. Almost two-thirds is in private ownership, with the remainder about equally divided between state ownership and Forest Service jurisdiction.

The forest range is located generally in the lower fringes of forest land adjacent to valley agricultural areas. A ground cover of palatable forage plants is found on some gentle slopes relatively free of undergrowth; but, more often, rough topography, stumps, down logs, and underbrush provide limited shrubby and herbaceous species of low forage value.

It is estimated that about 10 percent is in good condition, 27 percent is in fair condition, and 63 percent is in poor condition. The approximate carrying capacity is 20,000 AUMs with the private range accounting for 62 percent and the public range 38 percent.

Other Uses Even though timber production is the key use of the forest lands, they are extremely important for other purposes. Almost 90 percent of the subregion's runoff originates here. Over 70,000 people, representing 68 percent of the area's urban population, depend on forested watersheds for their source of domestic water.

The forest lands form a major part of the recreation resource; furnishing vast areas for hunting, fishing, and other outdoor activities. The public forest lands furnished areas and facilities for over 2-1/2 million recreation visits in 1965. These included use at developed recreation sites plus the general forest environment. The private forest lands furnished areas and facilities for another 375,000 visits during this period. Timber stands are the basic habitat for most of the subregion's deer and elk herds. Over 300,000 hunter visits were recorded on these forest areas in 1965.

Rangeland

In Subregion 8, 68,000 acres are reported to be rangeland. This is approximately 2 percent of the total land area. This accounts for less than 1 percent of all rangeland in the region. Tables 185 through 187 show the different categories of rangeland by ownership for the subregion and state.

Most of the range is found in small parcels intermingled with cropland and forest land in lower elevations adjacent to the Columbia River and the Cowlitz River. This was previously forest land, now covered with brush, weeds, and grass but generally unsuitable for more intensive agricultural production. Nearly 70 percent of the range is privately owned. The remainder is administered by the Forest Service or is state owned.

About 24 percent of the range is in good condition, 29 percent in fair condition, and 47 percent in poor condition. The approximate carrying capacity of the range is 13,000 AUMs, with private lands accounting for 73 percent and public lands 27 percent.

Table 185 - Rangeland and Forest Range Acreage by Range Type and Ownership, Subregion 8, 1966

	Federal					Non-Federal		
Category	BLM	FS	BIA	Other	Total	State & County	Private	Grand Total
	(1,000 acres)							
Rangeland								
Grasslands	-	2.0	-	-	2.0	1.0	23.5	26.5
Sagebrush	-	-	-	-	-	-	-	-
Brushland other than sage	-	16.0	-	-	16.0	2.0	23.4	41.4
Total	-	18.0	-	-	18.0	3.0	46.9	67.9
Forest Range 1/								
Commercial Forest	-	23.2	-	-	23.2	22.0	60.5	105.7
Noncommercial Forest								
Sub-alpine	-	-	-	-	-	-	-	-
Desert Fringe	-	-	-	-	-	-	-	-
Total (noncommercial)	-	-	-	-	-	-	-	-
Total (forest range)	-	23.2	-	-	23.2	22.0	60.5	105.7
Grand Total	-	41.2	-	-	41.2	25.0	107.4	173.6

1/ Forest and woodland grazed or potentially usable for forage production. Forest range acreage is included within the total forest statistics shown in table 182.

Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Table 186 - Rangeland and Forest Range Acreage by Range Type and Ownership, State of Oregon, Subregion 8, 1966

Category	Federal					Non-Federal		Grand Total
	BLM	FS	BIA	Other	Total	State & County	Private	
				(1,000 acres)				
Rangeland								
Grasslands	-	-	-	-	-	-	6.0	6.0
Sagebrush	-	-	-	-	-	-	-	-
Brushland other than sage	-	-	-	-	-	-	6.0	6.0
Total	-	-	-	-	-	-	12.0	12.0
Forest Range[1/]								
Commercial Forest	-	-	-	-	-	-	7.3	7.3
Noncommercial Forest								
Sub-alpine	-	-	-	-	-	-	-	-
Desert Fringe	-	-	-	-	-	-	-	-
Total (noncommercial)	-	-	-	-	-	-	-	-
Total (forest range)	-	-	-	-	-	-	7.3	7.3
Grand Total	-	-	-	-	-	-	19.3	19.3

1/ Forest and woodland grazed or potentially usable for forage production. Forest range acreage is included within the total forest statistics shown in table 182.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Table 187 - Rangeland and Forest Range Acreage by Range Type and Ownership, State of Washington, Subregion 8, 1966

Category	Federal					Non-Federal		Grand Total
	BLM	FS	BIA	Other	Total	State & County	Private	
				(1,000 acres)				
Rangeland								
Grasslands	-	2.0	-	-	2.0	1.0	17.5	20.5
Sagebrush	-	-	-	-	-	-	-	-
Brushland other than sage	-	16.0	-	-	16.0	2.0	17.4	35.4
Total	-	18.0	-	-	18.0	3.0	34.9	55.9
Forest Range[1/]								
Commercial Forest	-	23.2	-	-	23.2	22.0	53.2	98.4
Noncommercial Forest								
Sub-alpine	-	-	-	-	-	-	-	-
Desert Fringe	-	-	-	-	-	-	-	-
Total (noncommercial)	-	-	-	-	-	-	-	-
Total (forest range)	-	23.2	-	-	23.2	22.0	53.2	98.4
Grand Total	-	41.2	-	-	41.2	25.0	88.1	154.3

1/ Forest and woodland grazed or potentially usable for forage production. Forest range acreage is included within the total forest statistics shown on table 182.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Other Land

The other land use in the Lower Columbia Subregion consists of 258,600 acres or about 8 percent of the land area. This includes barren land and rock that make up about 59 percent of the total. About 31 percent is urban, industrial areas, farmsteads, airports, roads, and other miscellaneous use areas. Ten percent consists of water areas less than 40 acres and streams less than one-eighth mile wide. Table 188 shows the acreage and extent of other land in the Lower Columbia Subregion.

Table 188 - Other Land, Subregion 8, 1966

Kinds of Land Use	Washington	Oregon (1,000 acres)	Total	Percent
Barren	149.8	2.5	152.3	58.9
Roads and Railroads	28.0	1.6	29.6	11.5
Small water 1/	25.7	.5	26.2	10.1
Miscellaneous 2/	47.7	2.8	50.5	19.5
Total other land	251.2	7.4	258.6	100.0

1/ Water areas less than 40 acres in size and streams less than one-eighth mile in width.
2/ Includes urban and industrial areas, farmsteads, airports, and other areas.
Source: Compiled by the Soil Conservation Service River Basin Staff.

MINERAL RESOURCES

The eastern part of the subregion (including Mount St. Helens, Mount Rainier, and adjacent areas) is situated within the Cascade Range physiographic province. The bedrock consists largely of Tertiary andesitic, rhyolitic, and basaltic volcanic rocks, with some volcanic and interbedded sedimentary rocks of Quaternary age. Unconsolidated Quaternary alluvial and glacial sand, silt, and clay deposits mantle the bedrock in some areas. The Tertiary volcanic rock sequence is intruded by a few small igneous bodies of variable shape and composition. Occurrences of copper, silver, gold, lead, and zinc are located in this part of the subregion, mostly in Skamania County; production has been of minor importance.

The western part of the subregion is in the Puget Sound Basin and Willapa Hills physiographic provinces. The bedrock cropping out in the western part is about equally proportioned between Tertiary marine and nonmarine sedimentary rocks and intermediate to basic composition volcanic rocks. Areas of low relief are covered by Quaternary glacial and alluvial sand, gravel, and silt deposits. Coal, high-alumina clay, and mercury deposits are found in this part of the subregion; ferruginous bauxite occurs in areas underlain by basalt in Cowlitz County, Washington and Columbia County, Oregon. Alluvial sand and gravel deposits are numerous in the stream channels.

Present Mineral Industry and Outlook for the Future

Metals

Copper-Gold-Silver Deposits containing copper-gold-silver with associated minor amounts of lead-zinc, are found in the Mount St. Helens District on the headwaters of the Toutle and Lewis River, in northwestern Skamania County (figure 37). A considerable

amount of exploration and development work was done in the district but only three properties have recorded a small production or made test shipments. There has been no production in recent years (table 189).

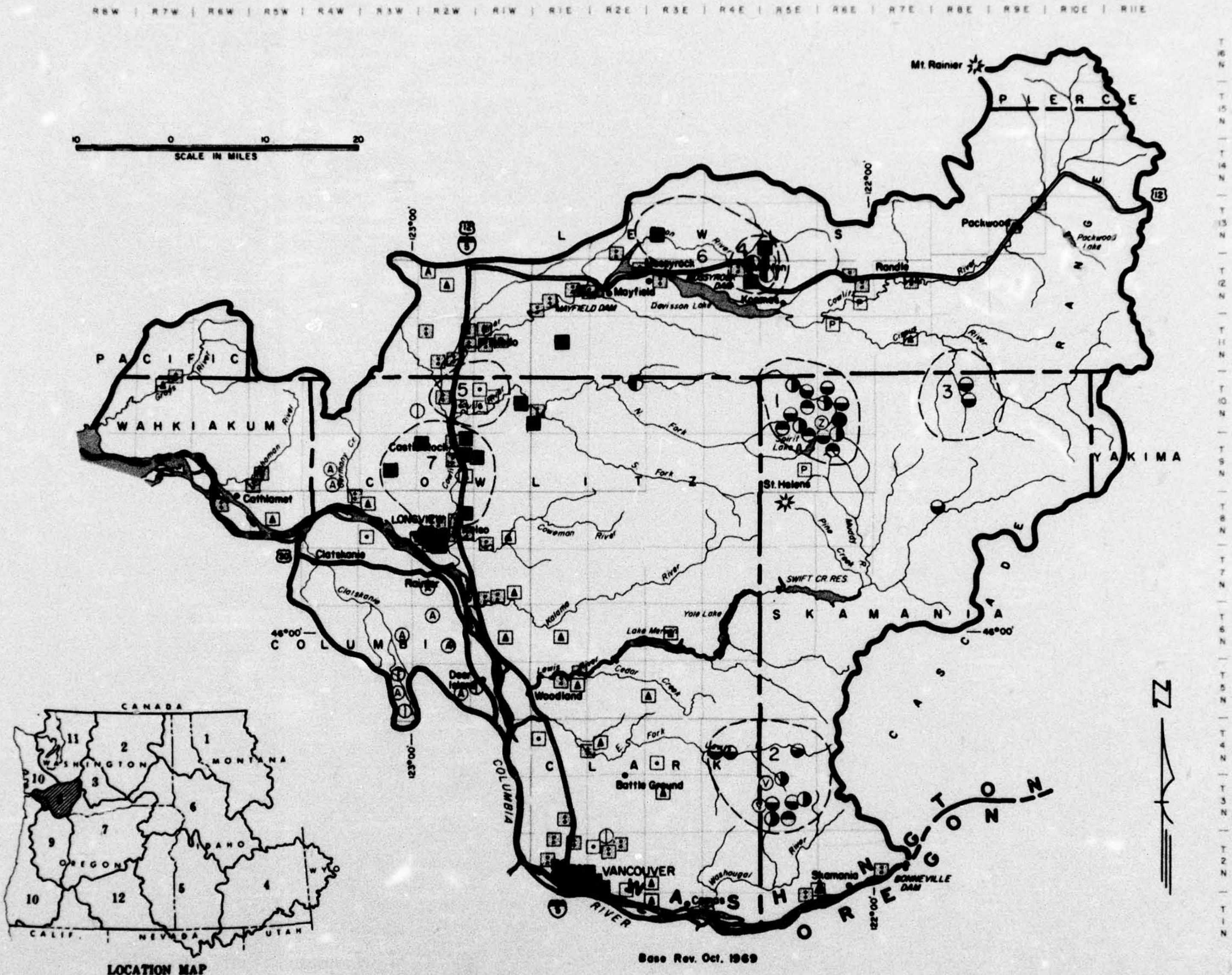
Table 189 - Mining Districts, Subregion 8

Index No. Fig.	District	County	Drainage	Size of Districts Production plus Reserves	References
1	Mount St. Helens	Skamania	Headwaters of the Toutle and Lewis Rivers. Lode deposits	Deposits contain copper, gold, and silver with associated minor amounts of lead and zinc. Production has been insignificant; some potential for future discoveries and development.	Huntting, M.T., 1956, Washington Div. of Mines & Geol.Bull.37, v. 1, Pt. 11, pp. 76-79
2	Washougal	do	Headwaters of the West Fork of Washougal River. Lode deposits.	Deposits contain copper, gold, and silver with minor associated vanadium. Test ore shipments only, some potential for future development.	do
3	McCoy Creek	do	Placer deposits on McCoy Creek, tributary of Cowlitz River.	Small gold production, no present activity.	do
4	Morton	Lewis	Headwaters of Tilton River, tributary to Cowlitz River near Morton. Lode deposits	Mercury deposits have produced 99 percent of mercury output of Washington. Ore is closely associated with coal measures. Production of 6,500 flasks during period 1926-1935. Small recent production and potential for future output.	Mackin, J.H., 1944, Washington Div. of Mines & Geol.Rept. of Inv. 6, 47 pp.
5	Cowlitz (Clay)	Cowlitz	Lower Toutle River, tributary to Cowlitz River.	High-alumina clay deposits. Reserves estimate 17 million tons average of 29 percent alumina. No production to date but favorable potential for the future.	Popoff, C.C., 1955, BuMines Rept. of Inv. 5157, 60 pp.
6	Cinebar-Morton (Coal)	Lewis Cowlitz	Tilton River, tributary to Cowlitz River	Reserves estimated at 44 million tons coal. Production small.	Beikman, H.M., et al, 1961, Washington Div. of Mines & Geol. Bull. 47, pp. 101-104.
7	Kelso-Castle Rock (Coal)	Cowlitz	Lower Cowlitz River near Kelso and Castle Rock.	Reserves estimate 150 million tons of coal and lignite, some can be strip mined. Small production.	

The Washougal District contains copper-gold-silver mineral occurrences with minor amounts of associated vanadium. The district is on the headwaters of the Washougal River, in southeastern Skamania County. A considerable amount of development work was done on at least four properties in the district but only test shipments of ore were made. There has been no recent production.

A small amount of gold was produced from placers on McCoy Creek in northern Skamania County and from the East Fork of the Lewis River in Clark County.

Although some relatively extensive exploration and development work has been done, no large copper-gold-silver ore bodies have been found. The metallic minerals occur in or near small granitic intrusive bodies of Tertiary age. The environment is geologically favorable from metallic mineral deposits and further



LEGEND

MINING DISTRICTS

1 Mount. St. Helens
2 Washougal
3 McCoy Creek
4 Morton
5 Cowlitz
6 Cinebar-Morton
7 Kelso-Castle Rock

METAL

- Ⓐ Aluminum - high alumina clay, bauxite
- Copper
- Gold
- Iron
- Lead
- Mercury
- Silver
- Ⓥ Vanadium
- Ⓩ Zinc

NON-METALLIC

- Basalt or volcanic rock
- Clay - pottery, refractory (other than alumina)
- Coal
- Ⓟ Pumice - Pumicite
- Sand and gravel

COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

MINERAL RESOURCES AND MINING DISTRICTS

LOWER COLUMBIA, SUBREGION 8

FIGURE 37

exploration could possibly disclose an ore body of economic size and grade.

Mercury Mercury occurs in several localities in Washington, often as a minor constituent of other metallic ores such as manganese and gold; however, 99 percent or more of all mercury produced in Washington has come from the Morton District in Lewis County. The district is about 2 miles in length. Mercury occurs in a series of coal-bearing Tertiary sedimentary rocks; some rich ore is in the coal. Two adjacent mines produced about 6,500 flasks in the period 1926-1935. There has been little active mining since 1940.

In addition to the two productive mines, there are more than a dozen prospects in the Morton District, many of which have not been completely explored. Probably hidden ore bodies exist that have potential for a small future production in periods of high prices for mercury.

Nonmetals

Construction Materials Commercially economic sand and gravel occurs largely in fluvial deposits in a wide belt along the Lower Columbia River and in the lower part of the Lewis River drainage in Clark County. Smaller deposits occur in the Cowlitz River Basin in Cowlitz County. Figure 37 shows the active or recently active sand and gravel pits in 1960. Sand and gravel ranked first in order of value of minerals produced in 1965 in Clark and Cowlitz counties, Washington, and Columbia County, Oregon.

Sand and gravel operations are generally located near the consumer. Resources are adequate for all foreseeable future demands except locally where other land uses may conflict with the removal of sand and gravel.

Crushed stone used for roadstone and aggregate is produced in every county. Most of the crushed stone is made from basalt or some other variety of volcanic rock. Quarries that were active in 1960 are shown in figure 37. Stone was first in order of value of minerals produced in 1965 in Skamania and Wahkiakum counties and second, after sand and gravel, in Clark and Cowlitz counties, Washington, and Columbia County, Oregon. Basalt and other volcanic rock resources are enormous and will supply any foreseeable future demand.

Clay is an important mineral resource. A brick plant at Ridgefield and another at Vancouver produced brick and tile in 1965

from clay mined in nearby pits. Clay ranked third in value of minerals produced in 1965 in Clark and Cowlitz counties.

High-alumina clays are found in the Cowlitz deposits located on the Toutle River about 7 miles northeast of Castle Rock; reserves are estimated to be about 17 million tons of clay averaging 29 percent alumina. Feasibility studies and tests have been made on these clays seeking a competitive method to produce alumina for the aluminum industry. However, no commercial production has been made to date. When technology succeeds in making high-alumina clay competitive with bauxite, there will be a ready market for this product in the large aluminum industry in the Columbia-North Pacific Region.

The resources of common clay suitable for brick and heavy clay products are adequate for all foreseeable future needs in the subregion, although locally deposits may be depleted or become unminable due to other land uses.

Alumina and Iron Ferruginous bauxite deposits cover a large area in Columbia County, Oregon, and smaller deposits extend north of the Columbia River in Cowlitz County. Exploration and metallurgical research work have been done to determine the feasibility of using ferruginous bauxite as a source of alumina and iron. To date no commercial production has been made; however, there is a potential future for these deposits as a source of raw material for the aluminum and possibly the iron industry.

A few limonitic iron deposits are present in Columbia and Cowlitz counties; small tonnages of this material have been mined for pigments and other nonferrous uses. The deposits are small and of little value as iron ore.

Pumice Pumice deposits are located in Skamania and Lewis counties in an area extending from Mount St. Helens northeastward to Mount Rainier (the source being Mount St. Helens). A small amount of pumice is produced intermittently from these deposits. The future output will depend on the market for the products. Reserves are adequate for all future demands.

Mineral Fuels

Coal beds occur in the vicinity of Cinebar and Morton and in the Kelso-Castle Rock area of Cowlitz and Lewis counties. Production has been small. The coal beds in the Cinebar area are badly deformed and an estimate of reserves is not available. The Morton area contains reserves estimated to be about 44 million tons.

In the Kelso-Castle Rock area reserves of coal and lignite are estimated to total about 150 million tons, part of which is strippable.

The future of coal production depends on the establishment of thermal-electric plants in the vicinity of the deposits that will use the coal as fuel.

SUBREGION 9
WILLAMETTE

ABSTRACT

Subregion 9 includes all of the Willamette River drainage basin and the Sandy River drainage. It consists of a south to north sloping trough between the Cascade, Calpooyia, and Coast Ranges. The low intensity rainfall of 40 to 70 inches has contributed a water stable structure in the generally moderately deep to very deep soils. This has created subsoil structure that allows infiltration and tends to prevent surface runoff. In general those soils associated with basic bedrock maintain structural stability after periods of excessive wetness. Many soil areas, particularly those areas associated with loess, develop fragipans that somewhat restrict permeability.

The nearly level bottomlands and low terraces are locations where most of the adapted crops (over 250) are produced at a moderately high level of intensity. Drainage, flooding, and restricted permeability in some of the soils are major problems of use.

The moderately to strongly sloping fans, footslopes, and high terraces that border the bottomlands and low terraces are locations where many of the seed crops, orchards, cereal crops, and pasture land are produced at a moderate level of intensity. Coarse fragments in the soil, moderate soil depths, and soil erosion constitute problems of agricultural use.

The major uses of the strongly to steeply sloping foothills and low mountains are pasture, forest, and low intensity production of cereals and seed crops. Water erosion, restrictive amounts of coarse fragments, shallow and moderate soil depths, are major problems of use.

The only uses of the steep high mountainous area are forest land or watershed. Shallow soil, high content of coarse fragments, and severe erosion are major problems that restrict use.

Mercury has been the most important metal produced in Subregion 9. The mercury output has accounted for more than half of the total value of all metals produced, amounting to about $1.6 million. The Black Butte mercury mine in the southwestern corner of the subregion has been the principal producer. Other metal production of minor importance has been that of gold, silver, copper, lead, zinc, and iron.

Nonmetal production has been of much greater importance than metal production. Mineral materials used for construction and building have accounted for more than 95 percent of the value of all mineral products; sand and gravel production for the period 1940-1964 is valued at $145 million; other nonmetals produced are clay, limestone, and crushed rock.

The total area of Subregion 9 consists of over 98 percent land and less than 2 percent water. Table 190 shows the land, water, and total watershed acreages by states and counties. Except for this table, areas of land only will be recorded in acreage throughout the following discussion.

Table 190 - Areas by State and County, Subregion 9, 1967

State and County	Water Area Sq.Mi.	Water Area Acres	Land Area[1/] Sq. Mi.	Land Area[1/] Acres	Total Area Sq. Mi.	Total Area Acres
Oregon						
Benton	.0	0	486.1	311,100	486.1	311,100
Clackamas	5.8	3,700	1,887.2	1,207,800	1,893.0	1,211,500
Columbia	9.6	6,100	136.1	87,100	145.7	93,200
Douglas	4.5	2,900	103.0	65,900	107.5	68,800
Lane	96.9	62,000	3,438.3	2,200,500	3,535.2	2,262,500
Lincoln	.2	100	14.4	9,200	14.6	9,300
Linn	8.9	5,700	2,288.1	1,464,400	2,297.0	1,470,100
Marion	2.0	1,300	1,173.0	750,700	1,175.0	752,000
Multnomah	32.7	20,900	423.6	271,100	456.3	292,000
Polk	1.2	800	640.2	409,700	641.4	410,500
Tillamook	.1	100	10.9	7,000	11.0	7,100
Washington	.0	0	630.9	403,800	630.9	403,800
Yamhill	4.4	2,800	647.6	414,500	652.0	417,300
Total Subregion	166.3	106,400	11,879.4	7,602,800	12,045.7	7,709,200

1/ The term "land" is defined to include all water bodies under 40 acres and streams under one-eighth mile in width.
Source: U.S.D.A. Conservation Needs Inventory adjusted to U.S. Census.

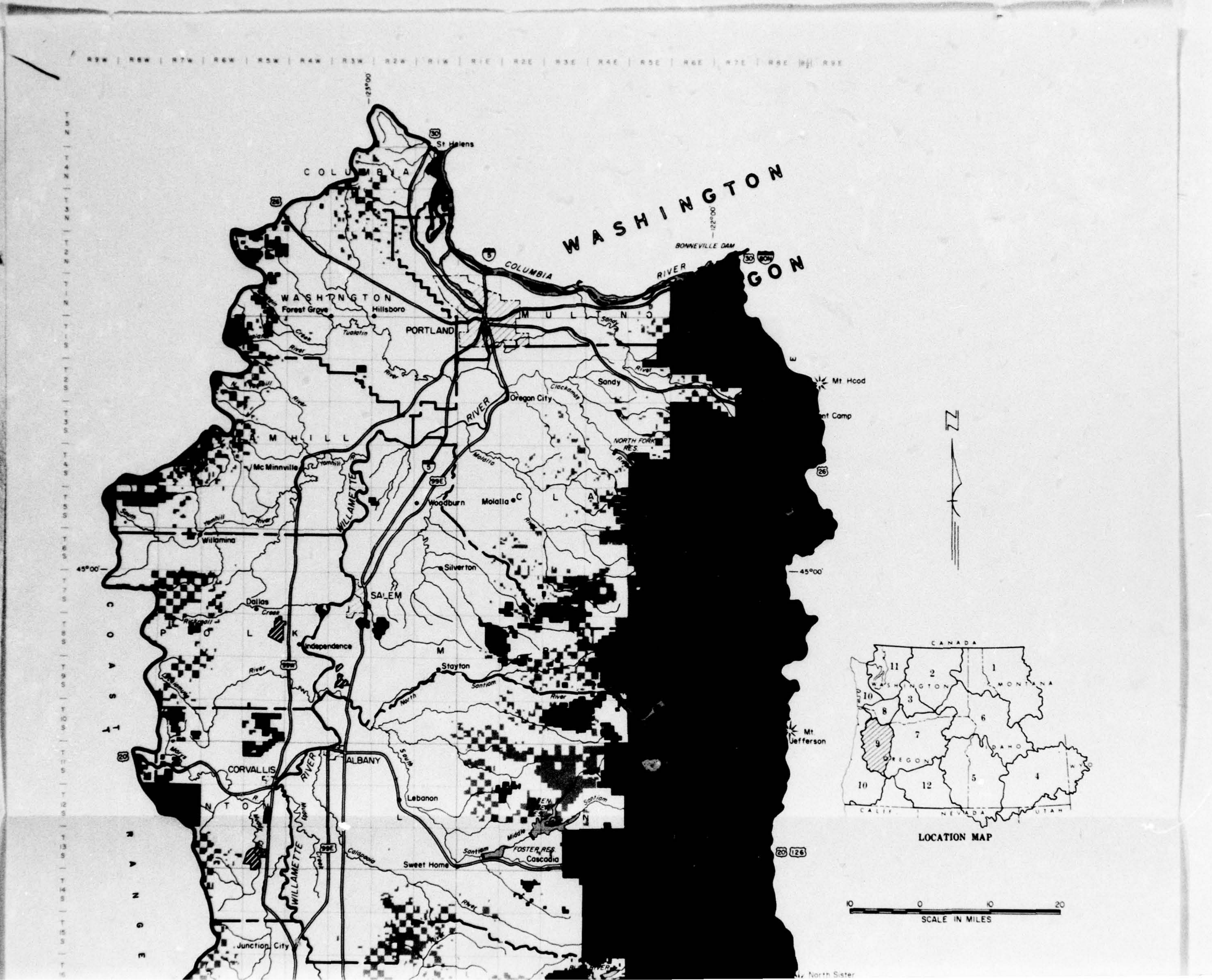
LAND

Factors of major importance to the land resource are: the ownership status, the soils, and the present use. The combination of these factors greatly influences the present and future utilization of the land resource.

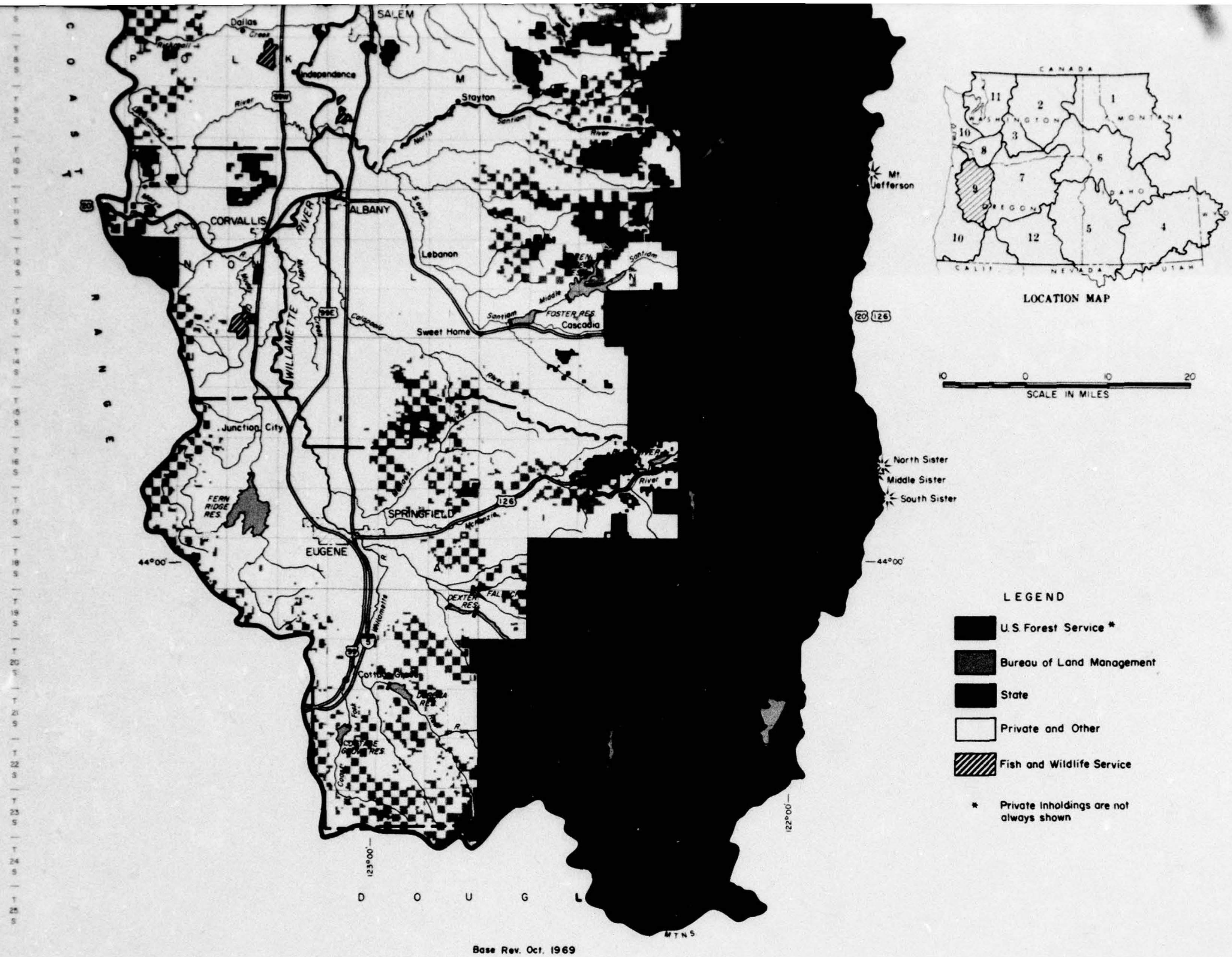
Land Ownership

Subregion 9 contains a little over 7.7 million acres. Private ownerships make up the single largest group with about 4.3 million acres or 57 percent of the total land area. The Federal Government is next with nearly 3 million acres or 39 percent of the total area. State, county, and local governments own the balance.

Over 2.4 million acres of the public lands are national forest. Another 420,000 acres are revested Oregon and California



WASHINGTON
GON
COLUMBIA
RIVER
BONNEVILLE DAM
St Helens
COLUMBIA
WASHINGTON
Forest Grove
Hillsboro
PORTLAND
Tualatin
MULTNO
Sandy
Clackamas
Oregon City
Mt Hood
NORTH FORK RES.
McMinnville
Yamhill
Woodburn
Molalla
Willamina
WILLAMETTE
Silverton
SALEM
Dallas
POLK
Independence
Stayton
Santiam
North
CORVALLIS
ALBANY
South
Lebanon
Mt Jefferson
FOSTER RES.
Cascadia
Sweet Home
Calapooia
Junction City
North Sister
COAST RANGE
45°00'
122°00'
123°00'
LOCATION MAP
CANADA
WASHINGTON
MONTANA
IDAHO
OREGON
CALIF
NEVADA
UTAH
SCALE IN MILES



COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

LAND OWNERSHIP

WILLAMETTE, SUBREGION 9

1968

FIGURE 38

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railroad grant lands and Public Domain. Another 47,000 acres are other Federal holdings within the Departments of the Interior and Defense. State, county, and municipal governments own almost 330,000 acres. About 2,000 acres are Indian lands. Table 191, Land Ownership, and figure 38, Land Ownership Map, show this information in more detail.

Table 191 - Land Ownership Acreage, Subregion 9, 1965

Administering Agencies	Oregon (1,000 acres)
Department of Agriculture	
Forest Service	2,465.8
Other Agriculture	-
Subtotal	2,465.8
Department of the Interior	
Bureau of Land Management	422.0
Bureau of Indian Affairs 1/	2.4
National Park Service	-
Fish & Wildlife Service	5.8
Bureau of Reclamation	-
Other Interior	1.3
Subtotal	431.5
Department of Defense	40.4
Other Federal	.1
Federal Subtotal	2,937.8
State	223.6
County	32.4
Municipal	72.8
Public Non-Federal Subtotal	328.8
Total Public	3,266.6
Total Private	4,336.2
Total Land Area	7,602.8

1/ Private lands held in trust by the Federal Government.
Source: General Services Administration Real Property Owned by the United States as of June 30, 1965, adjusted by the Land and Minerals Work Group.

Soils

Figure 39, the Soil Associations Map, shows the location and relative extent of each soil association. The associations are numbered in a general relationship to the position in the

landscape. Thus bottomlands and low terraces have the lowest numbers and alpine areas have the highest. The name of each association relates to the soil series representing general kinds of soil that are most extensive in the landscape. Wherever possible, established soil series are used in the name; however, where the soil series do not have classification status, the soil series name is not recorded. Generally up to 15 percent of any soil association in known areas may consist of inclusions of soils other than those identified. Such inclusions may be similar soils or they may be highly contrasting. However, in many high mountainous areas where detailed knowledge about the area is incomplete, extensive areas are included within delineations and inclusions of other soils may exceed the 15 percent.

Table 192 contains information about each soil association shown on figure 39. The symbol listed in the second column on the table is the same symbol shown on the soil association map. The table is organized to show land characteristics and the characteristics, qualities, and some interpretations of soil series representing the dominate and the contrasting kinds of soils in each association. The first six columns show some general land characteristics for each soil association. The next 11 columns show characteristics (permanent soil facts) of individual key soil series that represent dominate and contrasting soils. The following four show qualities inferred from the characteristics of these soils and the last four columns show interpretations concerning agricultural use based upon the foregoing soil characteristics and qualities. All of the representative soil series listed have status in classifications. A blank space in the soil series column indicates that the soil series name has no classification status.

The "soil groups" column contains soil associations that have broad similarities in some important characteristics and is frequently integrated into a position on the landscape.

The "percentage of association" column shows the extent of each soil in an association. Differences of the total soil percentage in each association from 100 percent are inclusions of other soils and land types. For example, soil association 12 lists a total of 70 percent. Knowledge of this area is somewhat limited so that 30 percent of its area consists of inclusions of other soils that are not defined.

Terms listed for permeability of water through the subsoil and permeability of substratum are:

Very rapid: Over 10 inches per hour.
Rapid: 5 to 10 inches per hour.
Moderately rapid: 2.50 to 5 inches per hour.
Moderate: 0.8 to 2.5 inches per hour.

LEGEND REVISED 1970

LEGEND

Soil Associations Map Symbol * Name of Association

Generally silty and sandy soils formed in alluvial sediments on bottomlands and low terraces.

1	Chehalis - Cloquato
2	Sauvies - Cloquato
3	Woodburn - Amity
4	Salem - Sifton

Generally silty and sandy soils with coarse fragments formed in glacial materials on terraces, plains and mountains.

5	Cazadero - Bornstedt
6	Dominantly Cryumbrepts

Generally clayey soils formed in materials mixed with residuum-colluvium from sedimentary bedrock on foothills and uplands.

7	Peavine - Willakenzie
8	Peavine - Klickitat

Generally silty or sandy soils formed in wind deposited or wind worked sediments on hilly uplands.

9	Kinton - Cascade

Generally silty soils formed in materials mixed with rocky residuum-colluvium from basic rock types on plateaus, canyons and mountains.

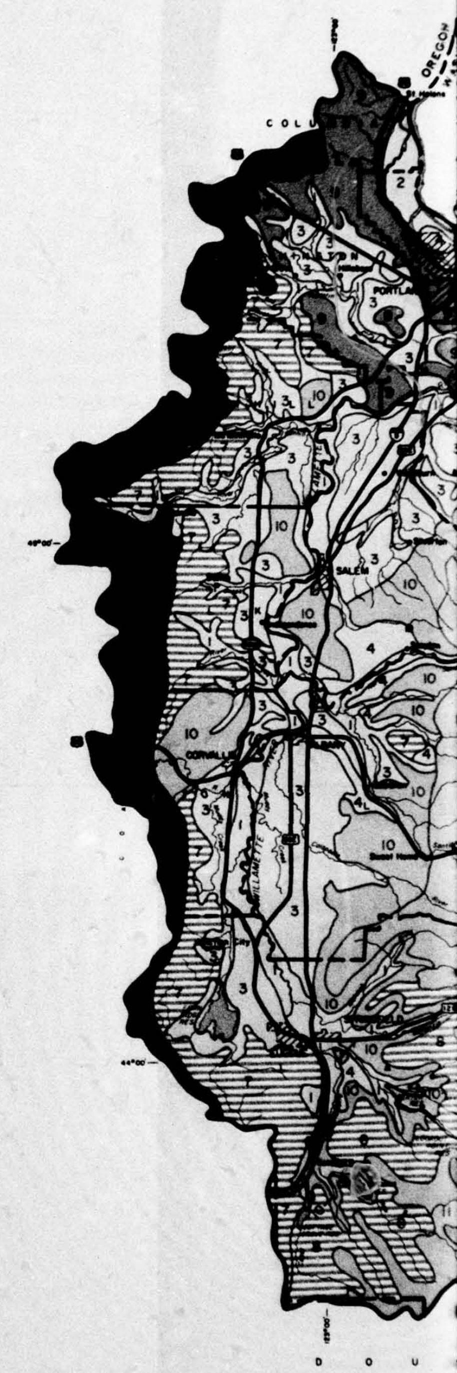
10	Jory - Nekia
11	Dominantly Haplumbrepts
12	Bull Run - Aschoff
13	Rockland

Generally silty soils formed in materials mixed with gravelly residuum-colluvium from sedimentary bedrock on mountains.

14	Astoria - Hembre
15	Honeygrove - Bohannon
16	Melby - Olyic

** Symbols are non-conotative and consistent only within each subregion. To compare delineations from one subregion to another refer to the name of the Soil Association.*

NOTE: The Soil Association name may include a series that does not fit the Soil Associations Group description. The Soil Association name is based on dominant series. The dominant of five series may be only 30 percent of the Soil Association. Thus a clayey textured soil series may be included in a group accurately described as generally silty and sandy in texture.



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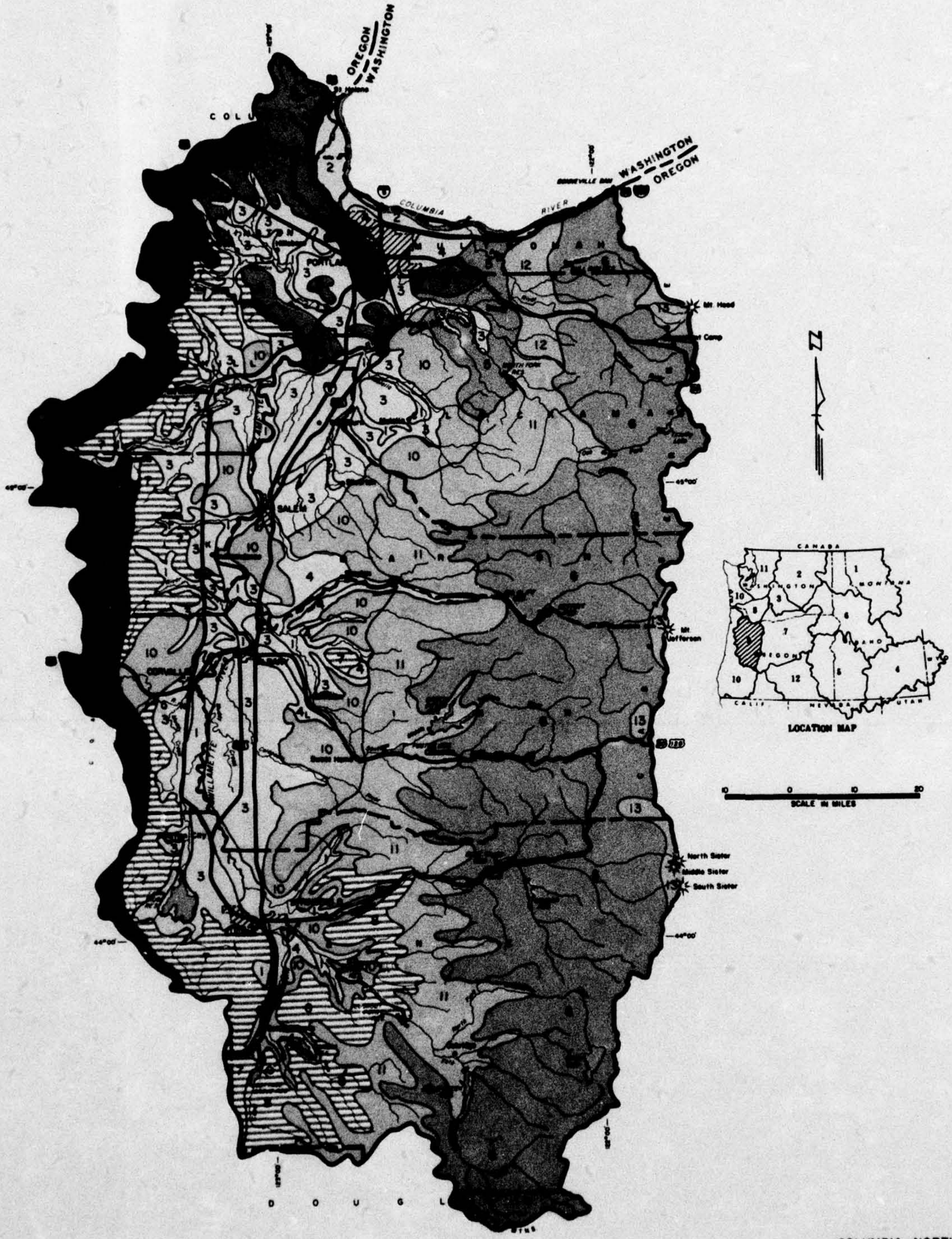

COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

SOIL ASSOCIATIONS

WILLAMETTE, SUBREGION 9

FIGURE 39

2

Table 192 - Characteristics and Qualities of Representative Soils,

Soil Groups	Soil Association: Map Sym.	Soil Association: Elevation Feet	Soil Association: Precip. Inches	Soil Association: Freeze free Season Days	Soil Association: Major land use	Classification: Great Group or Subgroup	Classification: Family	Classification: Series[2]	Percentage[3] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Soil Characteristics: Texture Surface Soil	Soil Characteristics: Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profil
Very deep soils with silty subsoils on nearly level slopes.	1	30-300	38-55	200-212	Cropland (cereals, vegetables, tree fruits cane fruits forage crops, and specialty crops)-dryland and irrigated	Cumulic Ultic Haploxerolls	Fine-silty, mixed, mesic	Chehalis	30	Flood plains (high positions)	Alluvium	Silty clay loam	Silty clay loam	None	-	60"+
						Cumulic Ultic Haploxerolls	Coarse-silty, mixed, mesic	Cloquato	25	Flood plains (low positions)	Alluvium	Silt loam	Silt loam	None	-	60"+
						Fluventic Haplaquolls	Fine-silty, mixed, noncalcareous, mesic	Wapato	25	Flood plains (depressions)	Alluvium	Silty clay loam	Silty clay loam	None	-	60"+
						Fluventic Haploxerolls	Coarse-loamy, mixed, mesic	Newberg	10	Flood plains (low positions)	Alluvium	Sandy loam	Sandy loam	Gravel	0-15 in profile	60"+
	2	20-100	30-45	200-215	Cropland (vegetables, cane fruits, strawberries nursery crops, and pasture)-irrigated (cereals, fruit and nut orchards and pasture)-dryland	Fluventic Haplaquolls (Typic)	Fine-silty, mixed, noncalcareous, mesic	Sauvie	50	Flood plains (gently rolling and hummocky)	Alluvium	Silt loam	Silty clay loam	None	-	20-30" seasona table
						Cumulic Ultic Haploxerolls	Coarse-silty, mixed, mesic	Cloquato	30	Flood plains and low terraces	Alluvium	Silt loam	Silt loam	None	-	60"+
	3	150-400	40-45	210-212	Cropland (forage crops, cereals, and grass seed)	Aquultic Argixerolls	Fine-silty, mixed, mesic	Woodburn	70	Terraces (high positions)	Alluvium	Silt loam	Silt clay loam	None	-	60"+
						Argiaquic Xeric Argialbolls	Fine-silty, mixed, mesic	Amity	20	Terraces (low positions)	Alluvium	Silt loam	Silty clay loam	None	-	60"+
						Typic Albaqualfs	Fine, montmorillonitic, mesic	Dayton	4	Terraces (depressions)	Alluvium	Silt loam	Clay	None	-	10-24" clayey subsoil

Table 192 - Characteristics and Qualities of Representative Soils, Subregion 9[1]

Percentage[5] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Soil Characteristics: Texture Surface Soil	Soil Characteristics: Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Range of: Major Capability Subclass: Irrigated[6]	Major Soil Problems	Suitable Land Treatment and Structures
30	Flood plains (high positions)	Alluvium	Silty clay loam	Silty clay loam	None	-	60"+	Moderate	Moderately slow	Good	High	I, IIw	I, IIw	Fertility and organic matter maintenance; occasional high water table	Residue mgmt; irrig. mgmt.
25	Flood plains (low positions)	Alluvium	Silt loam	Silt loam	None	-	60"+	Moderate	Moderate	Good	High	IIw	IIw	Flooding	Flood protection; winter cover; residue mgmt; irrigation management
25	Flood plains (depressions)	Alluvium	Silty clay loam	Silty clay loam	None	-	60"+	Moderately slow	Moderately slow	Poor	High	IIIw	-	Flooding; seasonal high water table	Flood protection; drainage; residue mgmt; cropping seq; irrig. mgmt.
10	Flood plains (low positions)	Alluvium	Sandy loam	Sandy loam	Gravel	0-15 in profile	60"+	Rapid	Rapid	Somewhat excessive	Medium	IIw	IIw	Flooding	Flood protection; residue mgmt; winter cover; irrigation mgmt.
50	Flood plains (gently rolling and hummocky)	Alluvium	Silt loam	Silty clay loam	None	-	20-30" over seasonal water table	Moderately slow	Slow	Somewhat poor	High	IIw, IIIw	IIw, IIIw	Flooding; high water table	Flood protection; drainage; residue mgmt; cropping seq; irrigation mgmt; diking
30	Flood plains and low terraces	Alluvium	Silt loam	Silt loam	None	-	60"+	Moderate	Moderate	Good	High	IIw	IIw	Flooding	Flood protection; residue mgmt; winter cover; irrigation mgmt.
70	Terraces (high positions)	Alluvium	Silt loam	Silt clay loam	None	-	60"+	Moderately slow	Moderately slow	Moderately Good	High	IIe, IIw, IIIe	IIe, IIw, IIIe	Erosion; wetness	Cross-slope opers; residue mgmt; cropping seq; subsurface tillage; drainage; irrigation mgmt.
20	Terraces (low positions)	Alluvium	Silt loam	Silty clay loam	None	-	60"+	Moderately slow	Moderately slow	Somewhat poor	High	IIw	IIw	High water table in winter and spring	Drainage; residue mgmt; cropping seq; irrigation management
4	Terraces (depressions)	Alluvium	Silt loam	Clay	None	-	10-24" over clayey subsoil	Very slow	Moderately slow to very slow	Poor	Medium	IIIw, IVw	IIIw, IVw	Perched water table over subsoil during rainy season	Drainage; residue mgmt; bedding; irrigation mgmt.

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Table 192 - Continued

Soil Association						Classification					Soil Characteristics					
Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth
Moderately deep soils with gravelly, loamy subsoils on nearly level slopes.	4	150-400	40-45	210-212	Cropland (cereals, vegetables, cane berries, and forage crops)- dryland and irrigated	Ultic Argixerolls	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Salem	50	Terraces	Alluvium	Gravelly silt loam	Gravelly clay loam	Gravel and sand	20-35 above 15-30" 60 below 15-30"	15-30" over gravel and sand
						Umbric Vitrandepts	Ashy over sandy or sandy-skeletal, mixed, mesic	Sifton	30	Terraces	Alluvium	Gravelly loam	Gravelly loam	Cobbles and gravel	20-35 above 16-24"; 35-80 below 16-24"	20-40" over gravel
						Typic Argiaquolls	Fine-loamy, mixed, non-calcareous, mesic	Clackamas	3	Terraces	Alluvium	Gravelly loam	Gravelly clay loam	Cobbles and gravel	20-35 above 20-36"; 35-80 below 20-36"	20-40" over compact gravel
Deep and very deep soils with fine-loamy and cobbly subsoils on gentle to moderate slopes.	5	450-1,200	45-80	180-200	Cropland (horticultural crops, forage crops, and cereals)- dryland	Ultic Haploxeralfs	Fine, mixed, mesic	Cazadero	50	Terraces (long & smooth)	Old alluvium	Silt loam	Silty clay loam to silty clay	Cobbles and gravel	20-35 below 36"	60"+
						Ultic Haploxeralfs	Fine-silty, mixed, mesic	Bornstedt	30	Terraces (slight depressions & footslopes)	Old alluvium	Silt loam	Silty clay loam	None	-	40-60" over clayey material
Moderately deep and deep cold soils with stony, loamy subsoils on moderate to extremely steep slopes.	6	2,500-6,000	70-90	80-120	Forest land [4/]	Cryumbrepts plus Cryorthods and Haplorthods and Rockland	Coarse-loamy, and loamy-skeletal, mixed, mesic	-	100	Uplands (moderate to steep slopes)	Colluvium and till over basic igneous rock	-	-	-	-	40-100"+ over bedrock
Moderately deep soils with clayey subsoils on gentle to moderate slopes.	7	250-1,600	40-70	140-200	Cropland (cereals, fruit orchards, berries, & forage crops) - dryland	Typic Haplohumults	Clayey, mixed, mesic	Peavine	50	Uplands (high foothills)	Colluvium and residuum from sedimentary rock	Silty clay loam	Silty clay	None	-	20-40" over fractured bedrock
					Rangeland	Ultic Haploxeralfs	Fine-loamy, mixed, mesic	Willakenzie	40	Uplands (low foothills)	Colluvium and residuum from sedimentary rock	Silty clay loam	Silty clay loam	None	-	20-40" over bedrock
					Forest land [4/]	Aquultic Haploxerolls	Very fine, mixed, mesic	Hazelair	5	Uplands (foot slopes on low foothills)	Alluvium and residuum from sedimentary rock	Silty clay loam or silt loam	Clay	None	-	20-40" over fractured bedrock

Table 192 - Continued

Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated[6]	Major Soil Problems	Suitable Land Treatment and Structures
Terraces	Alluvium	Gravelly silt loam	Gravelly clay loam	Gravel and sand	20-35 above 15-30" 60 below 15-30"	15-30" over gravel and sand	Moderate	Very rapid	Good	Low	IIs, IIIs	IIs, IIIs	Shallow and mod. deep over gravel & sand; gravelly profile	Residue mgmt; irrigation management
Terraces	Alluvium	Gravelly loam	Gravelly loam	Cobbles and gravel	20-35 above 16-24"; 35-80 below 16-24"	20-40" over gravel	Moderately rapid	Rapid	Good	Low	IIs, IIIs	IIs, IIIs	Gravelly and cobbly profile	Residue mgmt; irrigation management
Terraces	Alluvium	Gravelly loam	Gravelly clay loam	Cobbles and gravel	20-35 above 20-36"; 35-80 below 20-36"	20-40" over compact gravel	Moderately slow	Very slow to impervious	Somewhat poor	Low & Medium	IIIw	IIIw	High water table during rainy season; gravelly and cobbly profile	Drainage; residue mgmt; irrigation management
Terraces (long & smooth)	Old alluvium	Silt loam	Silty clay loam to silty clay	Cobbles and gravel	20-35 below 36"	60"+	Moderate & moderately slow	Moderately slow	Good	Medium	IIe, IIIe, IVe	-	Erosion	Cross-slope opers; residue mgmt; cropping seq; pastureland mgmt.
Terraces (slight depressions & footslopes)	Old alluvium	Silt loam	Silty clay loam	None	-	40-60" over clayey material	Moderate	Slow	Moderately good	Medium to high	IIw, IIIe, IVe	-	Erosion; wetness	Cross-slope opers; residue mgmt; cropping seq; drainage; pastureland mgmt.
Uplands (moderate to steep slopes)	Colluvium and till over basic igneous rock	-	-	-	-	40-100"+ over bedrock	Moderate to rapid	-	Good	Low to medium	VIs	-	Erosion; with sever cover or ground disturbance	Continued forest land management
Uplands (high foothills)	Colluvium and residuum from sedimentary rock	Silty clay loam	Silty clay	None	-	20-40" over fractured bedrock	Moderately slow	Slow to impervious	Good	Medium	IIIe, IVe, VIe, VIIe	-	Erosion; mod. deep over bedrock; clayey subsoil	Cross-slope opers; forest land mgmt; residue mgmt; pastureland mgmt; cropping seq; restrict log. opers during prolonged wet periods.
Uplands (low foothills)	Colluvium and residuum from sedimentary rock	Silty clay loam	Silty clay loam	None	-	20-40" over bedrock	Moderately slow	Slow to impervious	Good	Medium & high	IIIe, IVe, VIe, VIIe	-	Erosion; mod. deep and deep over bedrock	Same as above.
Uplands (foot slopes on low foothills)	Alluvium and residuum from sedimentary rock	Silty clay loam or silt loam	Clay	None	-	20-40" over fractured bedrock	Slow	Slow to impervious	Moderately good and somewhat poor	Medium and low	IIIe, IVe	-	Erosion; mod. deep over bedrock; clay subsoil	Cross-slope opers; residue mgmt; cropping seq; subsurface tillage; pastureland mgmt.

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Table 192 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage 3/ of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth
	8	750-1,200	60-80	180-200	Forest land 4/	Typic Haplohumults	Clayey, mixed, mesic	Peavine	40	Uplands (Terraces)	Colluvium and residuum from sedimentary rock (sandstone and shale)	Silty clay loam	Silty clay	None	-	20-40" over fractured bedrock
						Typic Haplumbrepts	Loamy-skeletal, mixed, mesic	Klickitat	30	Uplands (steep slopes)	Basic igneous rock	Loam	Cobbly clay loam	Cobbles	20-35 below 10" in profile	20-40" over bedrock
						Typic Haplohumults	Clayey, mixed, mesic	Honeygrove	15	Uplands (footslopes)	Sedimentary rock (sandstone)	Silty clay loam	Silty clay	None	-	40-60"+ over bedrock
						Typic Haplumbrepts	Fine-loamy, mixed, mesic	Bohannon	10	Uplands (ridgetops and steep slopes)	Sedimentary rock (sandstone and shale)	Gravelly loam	Gravelly loam	Gravel	20-35 in profile	20-40" over bedrock
Moderately deep soils with silty profiles on gentle to steep slopes.	9	100-1,500	40-70	190-212	Cropland (fruit orchards, berries, forage crops, and cereals)-dryland	Typic Fragiocrept	Fine-silty, mixed, mesic	Kinton	35	Uplands (slight depressions and footslopes)	Loess-like	Silt loam	Silty clay loam	None	-	20-40" to slightly compacted fragipan
					Forest land	Aquic Fragiumbrepts	Fine-silty, mixed, mesic	Cascade	30	Uplands (rolling foothills & ridges)	Loess over old alluvium	Silt loam	Silty clay loam	None	-	20-40" to fragipan
						Ultic Haploxeralfs	Fine-silty, mixed, mesic	Laurelwood	20	Uplands (long convex slopes)	Loess	Silt loam	Silty clay loam	None	-	60"+
Moderately deep and very deep soils with clayey subsoils on gentle to steep slopes.	10	300-1,200	40-60	190-200	Cropland (forage crops, fruit orchards, cane berries, & grass seed)-dryland	Xeric Haplohumults	Clayey, mixed, mesci	Jory	70	Uplands (rolling foothills)	Colluvium from basic igneous rock	Silty clay loam	Clay	Gravel, cobbles & stones	0-20 in profile	40-60"+ over bedrock
					Forest land	Xeric Haplohumults	Clayey, mixed, mesic	Nekia	20	Uplands (rolling to steep foothills)	Basic igneous rock	Silty clay loam	Clay	Gravel, cobbles & stones	0-20 in profile	20-40" over bedrock
						Lithic Ultic Haploxerolls	Loamy-skeletal, mixed, mesic	Witzel	3	Uplands (steep foothills)	Basic igneous rock	Very stony silty clay loam	Very stony silty clay loam	Cobbles & stones	35-80 in profile	10-20" over bedrock

Table 192 - Continued

er- ent- ge[3]/ of ssn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water holding Capacity	Range of: Major Capability Subclass: Dryland	Range of: Major Capability Subclass: Irrigated[6]/	Major Soil Problems	Suitable Land Treatment and Structures
40	Uplands (Terraces)	Colluvium and residuum from sedimentary rock (sandstone and shale)	Silty clay loam	Silty clay	None	-	20-40" over fractured bedrock	Moderately slow	Slow to impervious	Good	Medium	IIIe IVe VIe VIIe	-	Erosion; mod. deep over bedrock; clayey subsoil	Forest land mgmt; restrict logging during prolonged wet periods
30	Uplands (steep slopes)	Basic igneous rock	Loam	Cobbly clay loam	Cobbles	20-35 below 10" in profile	20-40" over bedrock	Moderate	Impervious	Good	Low	VIe, VIIe	-	Erosion; mod. deep over bedrock; cobbly subsoil; acid soil	Forest land management
15	Uplands (footslopes)	Sedimentary rock (sandstone)	Silty clay loam	Silty clay	None	-	40-60"+ over bedrock	Moderately slow	Impervious	Good	Medium & high	IVe, VIe	-	Erosion; acid soil	Forest land mgmt; restrict logging during prolonged wet periods
10	Uplands (ridgetops and steep slopes)	Sedimentary rock (sandstone and shale)	Gravelly loam	Gravelly loam	Gravel	20-35 in profile	20-40" over bedrock	Moderate	Impervious	Good	Low	VIe, VIIe	-	Erosion; mod. deep over bedrock; gravelly profile; acid soil	Forest land mgmt; restrict logging during prolonged wet periods
35	Uplands (slight depressions and footslopes)	Loess-like	Silt loam	Silty clay loam	None	-	20-40" to slightly compacted fragipan	Moderately slow	Mod rate to moderately slow	Moderately good	High	IIIe, IVe, VIe	-	Erosion; wetness	Cross-slope opers; residue mgmt; cropping seq; drainage; forest land mgmt; pastureland mgmt.
30	Uplands (rolling foothills & ridges)	Loess over old alluvium	Silt loam	Silty clay loam	None	-	20-40" to fragipan	Slow	Very slow to impervious	Somewhat poor	High	IIIe, IVe, VIe, VIIe	-	Erosion; wetness	Cross-slope opers; residue mgmt; cropping seq; drainage; forest land mgmt; pastureland mgmt.
20	Uplands (long convex slopes)	Loess	Silt loam	Silty clay loam	None	-	60"+	Moderate	Moderate	Good	High	IIe, IIIe, IVe, VIe	-	Erosion	Cross-slope opers; residue mgmt; cropping seq; forest land mgmt; pastureland mgmt.
70	Uplands (rolling foothills)	Colluvium from basic igneous rock	Silty clay loam	Clay	Gravel, cobbles & stones	0-20 in profile	40-60"+ over bedrock	Moderate	Moderately slow	Good	High	IIe, IIIe, IVe, VIe	-	Erosion on strong slopes	Cross-slope opers; residue mgmt; cropping seq; irrigation mgmt; forest land mgmt.
20	Uplands (rolling to steep foothills)	Basic igneous rock	Silty clay loam	Clay	Gravel, cobbles & stones	0-20 in profile	20-40" over bedrock	Moderate	Impervious	Good	Medium & high	IIIe, IVe, VIe	-	Erosion on moderate and strong slopes	Cross-slope opers; residue mgmt; cropping seq; irrig. mgmt; forest land mgmt; pastureland mgmt.
3	Uplands (steep foothills)	Basic igneous rock	Very stony silty clay loam	Very stony silty clay loam	Cobbles & stones	35-80 in profile	10-20" over bedrock	Moderate	Impervious	Good	Low	VIs	-	Shallow over bedrock stony profile	Forest land mgmt; pastureland mgmt.

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Table 192 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage 3/ of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth	Per S
	11	800-3,500	55-90	120-190	Forest land 4/ Cropland (grass seed, cereals, and forage crops)-dryland	Haplumbrepts plus Xerumbrepts and Haploxerolls	Fine and fine-loamy, mixed, mesic	-	100	Uplands (moderately steep)	Basic igneous rock	-	-	-	-	36-60" over breccia bedrock	Mod
Very deep soils with loamy and stony subsoils on strong to very steep slopes.	12	1,000-6,000	50-80	100-200	Forest land 4/	Andic Haplumbrepts	Coarse-silty, mixed, mesic	Bull Run	50	Uplands (footslopes)	Loess, basic igneous rock	Silt loam	Silt loam	None	-	60"+	Mod
						Andic Haplumbrepts	Loamy-skeletal, mixed, mesic	Aschoff	20	Uplands (footslopes)	Glacial till of basalt & andesite rocks	Stony silt loam	Stony clay loam	Stones	20-35 in profile	60"+	Mod
Shallow, rocky miscellaneous land with very cold soils on moderate to extremely steep slopes.	13	6,000-11,243	100-200	0-60	Other land	Rockland	Coarse-loamy, mixed	-	10	Uplands (steep mountains)	Igneous rock	-	-	-	-	Less than 10" over bedrock	Mod rap
Moderately deep to deep soils with fine-loamy and gravelly subsoils on gentle to very steep slopes.	14	300-1,500	35-125	140-225	Forest land 4/	Andic Haplumbrepts	Fine, mixed, mesic	Astoria	70	Uplands (moderately steep slopes)	Sedimentary rock (siltstone or shale)	Silty clay loam or silt loam	Silty clay loam & silty clay	None	-	40-100"+ over bedrock	Mod
						Typic Haplumbrepts	Fine-loamy, mixed, mesic	Hembre	20	Uplands (steep slopes and table-top ridges)	Basic igneous rock	Gravelly loam and silt loam	Gravelly loam & silty clay loam	Gravel, cobbles & stones	20-35 in profile	36-60"+ over bedrock	Mod
						Lithic Haplumbrepts	Loamy-skeletal, mixed, mesic	Kilchis	10	Uplands	Basic igneous rock	Stony loam	Very gravelly silt loam	Stones, cobbles & gravel	20-35 in profile	12-20" over bedrock	Mod
	15	750-1,500	60-80	180-200	Forest land 4/	Typic Haplohumults	Clayey, mixed, mesic	Honeygrove	45	Uplands (footslopes)	Sedimentary rock (sandstone)	Silty clay loam	Silty clay	None	-	40-60"+ over bedrock	Mod sl
						Typic Haplumbrepts	Fine-loamy, mixed, mesic	Bohannon	35	Uplands (ridgetops and steep slopes)	Sedimentary rock (sandstone and shale)	Gravelly loam	Gravelly loam	Gravel	20-35 in profile	20-40" over profile	Mod

Table 192 - Continued

Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of Major Capability Subclass: Dryland	Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
Uplands (moderately steep)	Basic igneous rock	-	-	-	-	36-60" over breccia bedrock	Moderate	-	Good	Medium	IVe	-	Erosion; with improper land use	Continued forest land mgmt; cross-slope opers; residue mgmt; cropping seq; soil amends; pastureland mgmt.
Uplands (foot-slopes)	Loess, basic igneous rock	Silt loam	Silt loam	None	-	60"+	Moderate	Moderate	Good	High	IIIe, IVe, VIe, VIIe	-	Erosion	Forest land management
Uplands (foot-slopes)	Glacial till of basalt & andesite rocks	Stony silt loam	Stony clay loam	Stones	20-35 in profile	60"+	Moderate	Moderate	Good	Medium	IIIe, IVe, VIe, VIIe	-	Erosion; stony profile	Forest land management
Uplands (steep mountains)	Igneous rock	-	-	-	-	Less than 10" over bedrock	Moderately rapid	-	Good	Low	VIIs, VIIIs	-	Shallow over bedrock; steep slopes	Protection and forest land management
Uplands (moderately steep slopes)	Sedimentary rock (siltstone or shale)	Silty clay loam or silt loam	Silty clay loam & silty clay	None	-	40-100"+ over bedrock	Moderate	Slow to impervious	Good	Medium & high	VIe	-	Erosion; acid soil	Forest land mgmt; restrict logging during prolonged wet periods
Uplands (steep slopes and table-top ridges)	Basic igneous rock	Gravelly loam and silt loam	Gravelly loam & silty clay loam	Gravel, cobbles & stones	20-35 in profile	36-60"+ over bedrock	Moderate	Impervious	Good	Low & Medium	VIe, VIIe	-	Erosion; acid soil	Forest land management
Uplands	Basic igneous rock	Stony loam	Very gravelly silt loam	Stones, cobbles & gravel	20-35 in profile	12-20" over bedrock	Moderate	Impervious	Good	Low	VIIs	-	Shallow over bedrock; stony and gravelly profile; acid soil	Forest land management
Uplands (foot-slopes)	Sedimentary rock (sandstone)	Silty clay loam	Silty clay	None	-	40-60"+ over bedrock	Moderately slow	Impervious	Good	Medium & high	IVe, VIe	-	Erosion; acid soil	Forest land management; restrict logging during prolonged wet periods
Uplands (ridge-tops and steep slopes)	Sedimentary rock (sandstone and shale)	Gravelly loam	Gravelly loam	Gravel	20-35 in profile	20-40" over profile	Moderate	Impervious	Good	Low	VIe, VIIe	-	Erosion; mod. deep over bedrock; gravelly profile; acid soil	Forest land mgmt; restrict logging during prolonged wet periods

Table 192 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage 3/ of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile
	16	500-2,000	60-70	170-190	Forest land 4/	Typic Dystrochrepts	Fine, mixed, mesic	Melby	50	Uplands (rolling and hilly)	Colluvium and residuum from sedimentary rock (siltstone and shale)	Silt loam	Silty clay	None	-	36-60" o sediment bedrock
						Typic Haplohumults	Fine-loamy,mixed, mesic	Olyic	35	Uplands (rolling & hilly)	Colluvium and residuum from basic igneous rock	Silt loam	Silty clay loam	None	-	40-60" o basalt b rock

1/ Based on data summarized during 1966.
2/ Only soil series names that have a status as reserved, tentative, or established are listed.
3/ Differences of total percentage in each soil association from 100 percent are inclusions of other soils and land types.
4/ For the upland forest soils, the above characteristics and qualities have been extended from a limited amount of survey data. Additional data and land use interpretations for forest soils are available in the Forest Land section of Appendix VIII, Land Measures and Watershed Protection. These areas include National Forest and adjacent non-Federal forest lands.
5/ Miscellaneous land types.
6/ Presently irrigated cropland.

SOURCE: National Cooperative Soil Survey.

Table 192 - Continued

Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated6/	Major Soil Problems	Suitable Land Treatment and Structures
Uplands (rolling and hilly)	Colluvium and residuum from sedimentary rock (siltstone and shale)	Silt loam	Silty clay	None	-	36-60" over sedimentary bedrock	Moderately slow	Impervious	Good	Medium & high	VIe, VIIe	-	Erosion on steep slopes; acid soil; restricted trafficability	Forest land mgmt; restrict logging operation during prolonged wet periods
Uplands (rolling & hilly)	Colluvium and residuum from basic igneous rock	Silt loam	Silty clay loam	None	-	40-60" over basalt bedrock	Moderate	Impervious	Good	Medium & high	VIe, VIIe	-	Erosion on steep slopes	Forest land management

s and land types.
amount of survey data.
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t lands.

2

AD-A036 572 PACIFIC NORTHWEST RIVER BASINS COMMISSION VANCOUVER WASH F/G 8/6
COLUMBIA-NORTH PACIFIC REGION COMPREHENSIVE FRAMEWORK STUDY OF --ETC(U)
JUN 70 C C BOWLSBY, R J COFFMAN, C R HUBBARD

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Moderately slow: 0.2 to 0.8 inches per hour.
Slow: 0.05 to 0.2 inches per hour.
Very slow: Less than 0.05 inches per hour.

Terms listed for total available water-holding capacity are:

Low: Less than 6 inches in profile.
Medium: 6 to 10 inches.
High: More than 10 inches in profile.

The irrigated capability subclasses are limitations and hazards of using presently irrigated lands.

A dash indicates that a column does not apply or there is insufficient data to complete it.

Subregion 9 is dominantly under an environment of 20-3,500 feet elevations, 30 to 80 inches of precipitation, and 120 to 200 days frost-free period. About 33 percent of the land has little or no coarse fragments and over 18 percent is soil formed in residuum-colluvium from sedimentary bedrock. Also less than 12 percent of the land area consists of soils formed in glacial materials. In addition to these generally unique soil characteristics, qualities and occurrence, the soils are involved with problems of wetness, acidity, and fertility.

Table 193 shows the estimated acreage and proportionate extent of the soil association in the Willamette Subregion.

Table 193 - Soil Associations Acreage, Subregion 9, 1966

Soil Association			
Map Symbol	Name	Oregon (1,000 acres)	Percent
1	Chehalis-Cloquato	600.0	7.9
2	Sauvie-Cloquato	90.0	1.2
3	Woodburn-Amity	860.0	11.3
4	Salem-Sifton	125.0	1.7
5	Cazadero-Bornstedt	138.0	1.8
6	Dominantly Cryumbropts	2,319.8	30.5
7	Peavine-Willakenzie	505.0	6.6
8	Peavine-Klickitat	275.0	3.6
9	Kinton-Cascade	285.0	3.8
10	Jory-Nekia	645.0	8.5
11	Dominantly Haplohumults	945.0	12.4
12	Bull Run-Aschoff	90.0	1.2
13	Rockland	105.0	1.4
14	Astoria-Hembre	220.0	2.9
15	Honeygrove-Bohannon	200.0	2.6
16	Melby-Olyic	200.0	2.6
Total Land Area		7,602.8	100.0

Source: National Cooperative Soil Survey

Interpretations and Evaluation

Table 194 relates the land capability classes to the Land Capability Map, figure 3. It must be realized that the Land Capability Map is highly generalized and a specific capability class on table 194 may not be shown. To determine the land capability of any particular area refer to the soil association symbols listed in the second column of the table and then locate the area of that symbol on the Soil Associations Map, figure 39. Table 194 also shows the acreage and extent of the dominant land capability class for practical segments of the landscape.

Table 194 - Summary and Distribution of Land Capability Classes, Subregion 9, 1966

Land Capability Classes	Distribution by Soil Associations 1/ Soil Association Map Symbols 2/	1,000 Acres	Percent	Inventoried 1,000 Acres 3/
Class I - Soils in Class I have no limitations or hazards. They are adopted to all uses with a minimum of conservation treatment other than standard conditioning ones. 4/	-	-	-	171.5
Class II - Soils in Class II have few limitations or hazards. Simple conservation practices are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	1-2-3	1,550.0	20.4	906.2
Class III - Soils in Class III have more limitations and hazards than those in Class II. They require more difficult or complex conservation practices when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	4-5-7-10	1,413.0	18.6	851.9
Class IV - Soils in Class IV have greater limitations and hazards than Class III. Still more difficult or complex measures are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	9-11	1,230.0	16.2	872.2
Class V - Soils in Class V have more limitations than Class IV. They are generally unsuited for cultivation, but are well suited for grazing and forestry use. They require good management practices. 4/	-	-	-	1.8
Class VI - Soils in Class VI have severe limitations or hazards that make them generally unsuited for cultivation. They are suited largely to pasture, range, woodland or wildlife.	6-8-12-14-15-16	3,304.8	43.4	4,551.8
Class VII - Soils in Class VII have very severe limitations and hazards that make them generally unsuited for cultivation. They are suited to grazing, noncommercial, woodland or wildlife.	-	-	-	119.0
Class VIII - Soils and land forms in Class VIII have limitations and hazards that prevent their use for cultivated crops, pasture, range or woodland. They may be used for recreation, wildlife or water supply.	13	105.0	1.4	128.4
Total Land		7,602.8	100.0	7,602.8

1/ Class I and 10 percent of other capability classes may be included in areas of Class II. Up to 25 percent of other capability classes may be included in Classes III and IV. Class V and up to 40 percent of other capability classes may be included in Classes VI, VII, and VIII. In areas of rainfall less than 12 inches, large areas of Class VI can be potential Classes I through IV where irrigation water is available.
2/ Refer to the Subregional Soil Association Map, figure 39.
3/ Taken from table 8.
4/ Capability Classes I and V are distributed in small segregated areas over segments of the landscape. Many small areas could not be delineated on the map. This added detail, although still generalized, is commensurate with the subregional level of generalization.
Source: National Cooperative Soil Survey and U.S.D.A. Conservation Needs Inventory adjusted.

Classified on table 195 is the dominant water storage capacity for each soil association in Subregion 9. Each class on the table relates to a similar class on the Water Storage Capacity, figure 4. To locate those areas having contrasting water storage capacity in the upper 5 feet of soil, refer to figure 4, to figure 39 (the subregional Soil Association Map), and to the following

table. The class letter symbol in the first column and the Soil Association Map numerical symbol listed in the second column may be used to locate those areas having contrasting water storage capacity. Complete utilization of this storage contributes toward more stable and sustained streamflow.

Table 195 - Water Storage Capacity of Soils Generalized to the Soil Associations, Subregion 9, 1966

Classes of Water Storage Capacity 1/	Soil Association Symbols	1,000 Acres	Percent
Class A - Water storage in the soil profile more than 20,000 acre-feet per township.	1-2-3	1,550.0	20.4
Class B - Water storage in the soil profile 10,000 to 20,000 acre-feet per township.	5-7-8-9 10-11-16	2,993.0	39.3
Class C - Water storage in the soil profile 5,000 to 10,000 acre-feet per township.	4-6 12-14-15	2,954.8	38.9
Class D - Water storage in the soil profile less than 5,000 acre-feet per township.	13	105.0	1.4
Total		7,602.8	100.0

1/ Measurement of the water storage capacity is limited to the upper 5 feet of soil or to bedrock.
Source: National Cooperative Soil Survey.

Cover and Land Use

The major cover and land uses are dominated by forest land and cropland with a minor amount of rangeland and other land. Although the other land acreage is small, it is very important. The total areas of the four major land uses have been summarized by acreage and ownership on table 196 and shown on figure 40. Only extensive areas of single use have been shown. Tables showing the details of land use appear after the discussion of cropland, forest land, rangeland, and other land.

Cropland

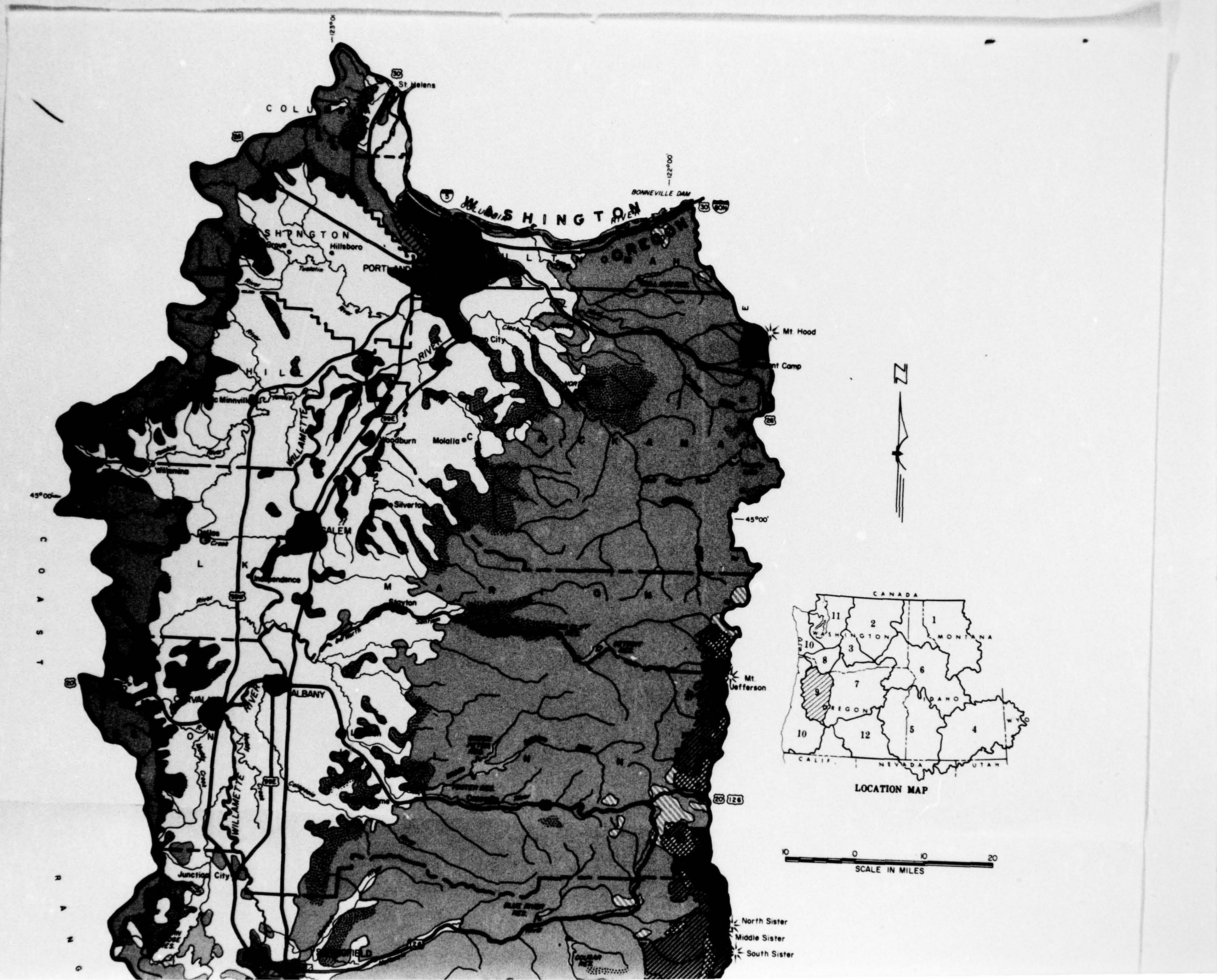
Cropland in Subregion 9 includes nearly a million and a half acres on the bottomlands, terraces, and foothills. Over 250 kinds of crops are presently identified as adapted at elevations up to 300 feet above sea level. Over one-third of the cropland consists

Table 196 - Cover and Land Use by Ownership, Subregion 9, 1966

Ownership	Cropland	Forest Land	Rangeland	Other Land	Total
			(1,000 acres)		
Department of Agriculture					
Forest Service	-	2,368.6	10.0	87.2	2,465.8
Other Agriculture	-	-	-	-	-
	-	2,368.6	10.0	87.2	2,465.8
Department of the Interior					
Bureau of Land Management	-	410.0	8.0	4.0	422.0
Bureau of Indian Affairs 1/	-	2.4	-	-	2.4
National Park Service	-	-	-	-	-
Fish & Wildlife Service	1.6	-	3.0	1.2	5.8
Bureau of Reclamation	-	-	-	-	-
Other Interior	-	-	-	1.3	1.3
	1.6	412.4	11.0	6.5	431.5
Department of Defense	-	-	-	40.4	40.4
Other Federal	-	-	-	.1	.1
Federal Subtotal	1.6	2,781.0	21.0	134.2	2,937.8
State	12.0	132.6	3.0	76.0	223.6
County	-	20.0	-	12.4	32.4
Municipal	-	20.0	-	52.8	72.8
Public Total	13.6	2,953.6	24.0	275.4	3,266.6
Private Total	1,442.5	2,318.4	34.8	540.5	4,336.2
Total Land Area	1,456.1	5,272.0	58.8	815.9	7,602.8

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.

of high quality soils on bottomlands and low terraces. Most of this portion of the cropland is intensively used; however, in addition, almost 10 percent of the bottomland is presently devoted to urban, industrial, roads, and other uses that do not use it as an agricultural resource. Preferably, all of this one-third of the cropland should be reserved for agricultural uses. The remaining two-thirds of the cropland area occurs on higher terraces, fans, and foothills under annual or perennial crops at a moderate to low intensity of agricultural use. Throughout the subregion native cover includes woody types of plants. In order to profitably grow the majority of crops, it is necessary to create an artificial soil environment by the use of soil amendments (lime) and a complete range of commercial fertilizers. Generally the cropland receives sufficient natural moisture to grow a range of adapted crops; however, supplemental irrigation permits a wider range of crops, more intensive management and greater production of most crops. Presently about 17 percent of the cropland is being irrigated. Table 197 lists the acreage and extent for each of the representative categories of crops.



WASHINGTON
OREGON
COLUMBIA RIVER
BONNEVILLE DAM
122°00'
123°00'
45°00'
St Helens
Hillsboro
PORTLAND
Woodburn
Molalla
Silverton
SALEM
Independence
Stayton
ALBANY
Junction City
Willamina
Dallas
Mt. Hood
Mt. Jefferson
North Sister
Middle Sister
South Sister
WILLAMETTE
RIVER
COAST RANGE
LOCATION MAP
CANADA
MONTANA
IDAHO
NEVADA
UTAH
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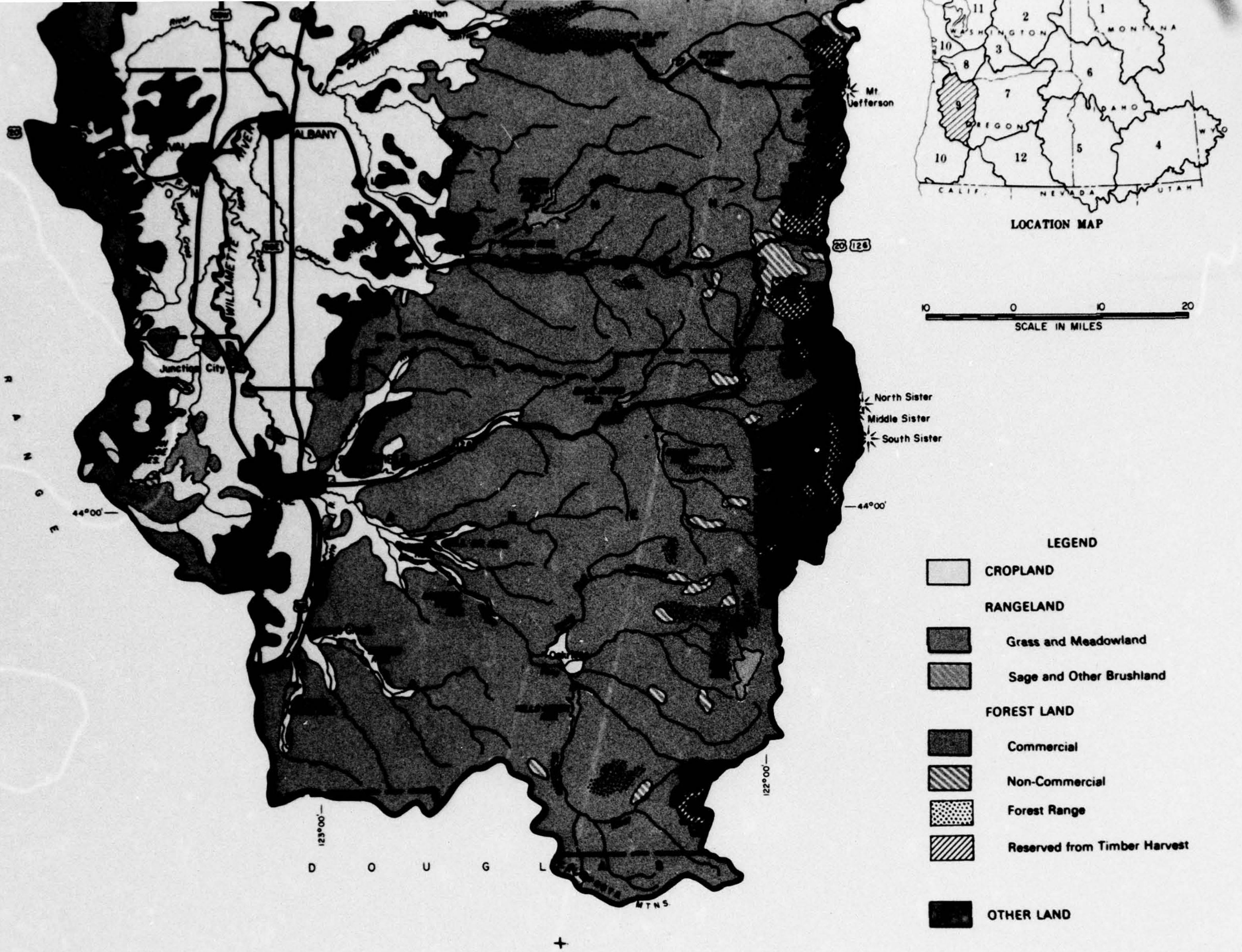


COLUMBIA–NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

GENERALIZED COVER AND LAND USE

WILLAMETTE, SUBREGION 9

1968

FIGURE 40

Table 197 - Cropland Acreage of Representative Categories of Crops, Subregion 9, 1966

Categories of Crops	Oregon (1,000 acres)	Percent
Dryland Cropland 1/		
Forage crops	344.0	23.6
Close grown field crops	766.2	52.6
Orchards and vineyards	91.5	6.3
Specialty crops 2/	10.7	0.7
Total dryland crops	1,212.4	83.2
Irrigated Cropland 1/		
Forage crops	85.2	5.9
Row crops 3/	108.5	7.5
Specialty crops 2/	50.0	3.4
Total irrigated crops	243.7	16.8
Total cropland	1,456.1	100.0

1/ Taken from the Willamette Basin Type 2 Report.
2/ Includes hops, mint, and innumerable crops of limited acreage.
3/ Includes corn, beans, and other vegetable crops.
Source: Willamette Basin Type 2 Report and U.S.D.A. Conservation *Needs Inventory* adjusted.

Forest Land

The forest area covers 5,272,000 acres or 70 percent of the land area in Subregion 9. It completely borders the basin except at the north end where the Willamette River empties into the Columbia. Forests extend along the ridgetops and down the slopes, until they blend with the agricultural lands along the valley floors.

Almost 3 million acres, or 56 percent, of the forest land is publicly owned This public land is 80 percent national forest; 14 percent revested Oregon and California railroad grant lands and Public Domain; 6 percent State of Oregon, county, and municipally owned. The private land amounts to 44 percent or 2.3 million acres. Table 198 shows this ownership in detail.

Timber Nearly 5 million acres of the forest land is classed as commercial, mainly softwood. The principal species is Douglas-fir. Other species and types include the western hemlock and the fir-spruce types. Less common are the lodgepole and white pine. The balance of slightly over 300,000 acres is classed as noncommercial forest, over two-thirds on lands reserved from timber harvesting, the other third on nonproductive areas.

Sixty-four percent of the commercial forest area is in the sawtimber class. Ten percent is currently pole-timber and 23 percent is classed as saplings and seedlings. Only 3 percent is nonstocked. About 200,000 acres have been reserved from timber

Table 198 - Forest Land Acreage by Generalized Type and Ownership, Subregion 9, 1966

Ownership	Commercial Forest Land	Noncommercial Forest Land: Productive Reserved	Noncommercial Forest Land: Unproductive Reserved	Noncommercial Forest Land: Unproductive	Total
	(1,000 acres)				
Forest Service	2,100.3	180.7	43.5	44.1	2,368.6
Bureau of Land Management	394.0	-	-	16.0	410.0
Bureau of Indian Affairs 1/	2.4	-	-	-	2.4
National Park Service	-	-	-	-	-
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	-	-	-	-	-
Department of Defense	-	-	-	-	-
Other Federal	-	-	-	-	-
Federal Subtotal	2,496.7	180.7	43.5	60.1	2,781.0
State	126.6	6.0	-	-	132.6
County	20.0	-	-	-	20.0
Municipal	14.0	5.0	-	1.0	20.0
Public Total	2,657.3	191.7	43.5	61.1	2,953.6
Private Total	2,304.0	-	-	14.4	2,318.4
Grand Total	4,961.3	191.7	43.5	75.5	5,272.0

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest Experiment Station.

harvest by wilderness type classifications. The nonreserved balance supports nearly 170 billion board feet of commercial sawtimber. The forest industries furnish 38 percent of the total manufacturing employment.

Forest Range The forest range in Subregion 9 includes 457,000 acres classified as commercial forest land and 11,000 acres of noncommercial forest. This 468,000 acres represents 9 percent of the total forest land. About 73 percent of the forest range is privately owned.

Most of the forest range is located in the lower fringes of the forest land adjacent to the valley agricultural areas. Some is on gentle slopes which are relatively free of undergrowth and have a ground cover of palatable forage plants. Generally the forest areas are not heavily used by livestock. Access and movement are difficult, and the limited number of shrubby and herbaceous species are mostly of low forage value. In the high mountains open range areas including meadows, subalpine glades, and grassy hillsides and ridges furnish excellent summer range. Only 10 percent of the forest range is estimated to be in good condition, 27 percent in fair condition, and 63 percent in poor condition.

Frequently some forest range is only temporarily available on recently cutover forest land before tree cover is established. On public lands, grazing use by domestic stock is limited. A small amount of grazing is permitted on national forest land in the upper slope forest zone of the Cascades where there are small wet meadows and open timber stands.

Other Uses Even though the subregion is the number two timber producer, its forest lands are extremely important for other purposes. Seventy-nine percent of the water supply originates on these lands. Domestic water supply systems, furnishing water for nearly all of the basin's urban population, originate on these forested watersheds.

The forest lands form a major part of the recreation resource, furnishing water and land areas for fishing, hunting, and other activities. The public forest land furnished areas and facilities for nearly 14 million recreation visits in 1965. These included use at developed recreation sites, winter sports areas, and the general forest environment. The private forest land furnished areas for another 350,000 visits during this period. The forests also furnish habitat for a significant portion of big game. Some 400,000 hunter visits were recorded in the forested areas of the subregion in 1965.

Rangeland

In the Willamette Subregion, 59,000 acres are rangeland representing less than 1 percent of the total land area. This subregion accounts for less than 1 percent of all rangeland in the region. Table 199 shows the different categories of rangeland by ownership.

Table 199 - Rangeland and Forest Range Acreage by Range Type and Ownership, Subregion 9, 1966

	Federal					Non-Federal		
Category	BLM	FS	BIA	Other	Total	State & County	Private	Total
				(1,000 acres)				
Rangeland								
Grasslands	6.0	10.0	-	1.4	17.4	2.1	22.6	42.1
Sagebrush	-	-	-	-	-	-	-	-
Brushland other than sage	2.0	-	-	1.6	3.6	.9	12.2	16.7
Total	8.0	10.0	-	3.0	21.0	3.0	34.8	58.8
Forest Range 1/								
Commercial Forest	47.8	50.8	-	-	98.6	24.6	333.3	456.5
Noncommercial Forest								
Sub-alpine	3.0	.2	-	-	3.2	1.0	7.0	11.2
Desert Fringe	-	-	-	-	-	-	-	-
Total (noncommercial)	3.0	.2	-	-	3.2	1.0	7.0	11.2
Total (forest range)	50.8	51.0	-	-	101.8	25.6	340.3	467.7
Grand Total	58.8	61.0	-	3.0	122.8	28.6	375.1	526.5

1/ Forest and woodland grazed or potentially usable for forage production. The forest range acreage is included within the total forest statistics shown in table 198.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Most of the range is found in small parcels intermingled with cropland and forest land around the edge of the valleys of the Willamette and its major tributaries. This was previously forest land, now covered with brush, weeds, and grass. Repeated burning since the original logging has kept the trees from coming back and some areas have been seeded to grass.

It is estimated that about 22 percent of the range is in good condition, 28 percent is in fair condition, and 50 percent is in poor condition with compacted and eroded soil. Invasion of noxious and unpalatable weeds is common. Rough topography, stumps, down logs, and patches of brush make livestock movement difficult.

Other Land

The other land use in Subregion 9 consists of over 75 percent of urban, industrial areas, farmsteads, airports, roads, and other miscellaneous use. About 16 percent is barren and rock areas and almost 9 percent consists of water areas of leas than 40 acres. The particular importance of the other land in Subregion 9 is that about 75 percent has been taken out of the highest producing cropland. Table 200 shows the acreage and extent of other land.

Table 200 - Other Land, Subregion 9, 1966

Kinds of Land Use	Oregon (1,000 acres)	Percent
Barren	128.4	15.7
Roads and railroads	60.0	7.4
Small water 1/	72.4	8.9
Miscellaneous 2/	555.1	68.0
Total other land	815.9	100.0

1/ Water areas less than 40 acres in size and streams less than one-eighth mile in width.
2/ Includes urban and industrial areas, farmsteads, airports, and other areas.
Source: Compiled by the Soil Conservation Service River Basin Staff.

Metals

Subregion 9 includes the Willamette River Valley, covered mostly by Tertiary marine sediments and Quaternary nonmarine terrace deposits of clay, silt, sand and gravel. The western slope of the Cascade Range falls within the subregion by reason of the tributary drainage to the Willamette. This area is predominantly covered by Tertiary volcanic rocks; the lower slopes by black basalt and breccias with minor amounts of rhyolite, andesite, and tuff, and the higher slopes by andesite and breccias. The geologic environment is not favorable for large or significant deposits of metallic ores and, with exception of one major mercury producer, metal production has been of minor importance. Mercury output has accounted for more than half of the total value of all metals produced; other metal output has been gold, silver, copper, lead, zinc, and iron. A small amount of mercury was produced in 1965-66; otherwise no metal output has come from the subregion since 1962. Table 201 shows the amount, value, and location of metals produced in the subregion (figure 41).

Table 201 - Metals Produced, Subregion 9, 1966

Commodity	Quantity	Value	Production Years	County
Copper (recoverable content of ores, etc.) (short tons)	217	$ 61,341	1908, 1912-13, 1915-17, 1923-24, 1926, 1928, 1930, 1932-37, 1939-42, 1945-47, 1949-52, 1962	Lane, Marion
Gold (recoverable content of ores, etc.) (troy ounces)	35,618	899,133	1902-19, 1921, 1923-26 1928-42, 1945-47, 1949-52, 1958, 1960-62	Benton, Clackamas, Lane, Linn, Marion
Lead (recoverable content of ores, etc.)1/ (short tons)	303	36,807	1908, 1912-13, 1915-16, 1918, 1926, 1930, 1932-37, 1939, 1942, 1945-47, 1949-52, 1961-62	Lane
Mercury (76-pound flasks)	16,250	1,606,946	1900-01, 1905, 1918-19, 1916-19, 1927-43, 1951, 1956-57, 1965-66	Clackamas, Lane
Silver (recoverable content of ores, etc.) (troy ounces)	74,136	53,564	1902-03, 1905-19, 1921, 1923-26, 1928-42, 1945-47, 1949-52, 1958, 1960-62	Benton, Clackamas, Lane, Linn, Marion
Zinc (recoverable content of ores, etc.)2/ (short tons)	119	18,456	1930, 1932-34, 1936-37, 1945, 1947, 1949-51, 1961	Lane
Total		$2,676,247		

1/ Excludes lead produced in Marion County.
2/ Excludes zinc produced in Marion County.

The Black Butte mercury district is located near Little River at the head of Coast Fork, a tributary to the Willamette. The Black Butte is one of the oldest mercury mines in Oregon and has produced about 15 percent of the total mercury output of the state; total production has been about 16,000 flasks.

Also, on the upper Willamette, the Bohemia District is located at the head of Sharps and Frank Brice Creeks, tributaries to thè Row River in Lane County. Gold was discovered in this district in 1858. Early gold production came from placer deposits, but, since 1900, virtually all gold has come from lode deposits containing some silver and minor amounts of copper, lead, and zinc. Total production has been approximately 18,000 ounces of gold, 55,000 ounces of silver, 190 tons of copper, 300 tons of lead, and 119 tons of zinc.

The Blue River District is located at the head of Gate Creek and the Blue River, tributaries to the McKenzie River in Lane County. Gold was discovered here in about 1887, and principal production was from 1902 to 1912. Some gold was produced mostly from placers before 1900. Total production from the district was about 8,000 ounces of gold, 12,800 ounces of silver, 2 tons of copper, and one-half ton of lead.

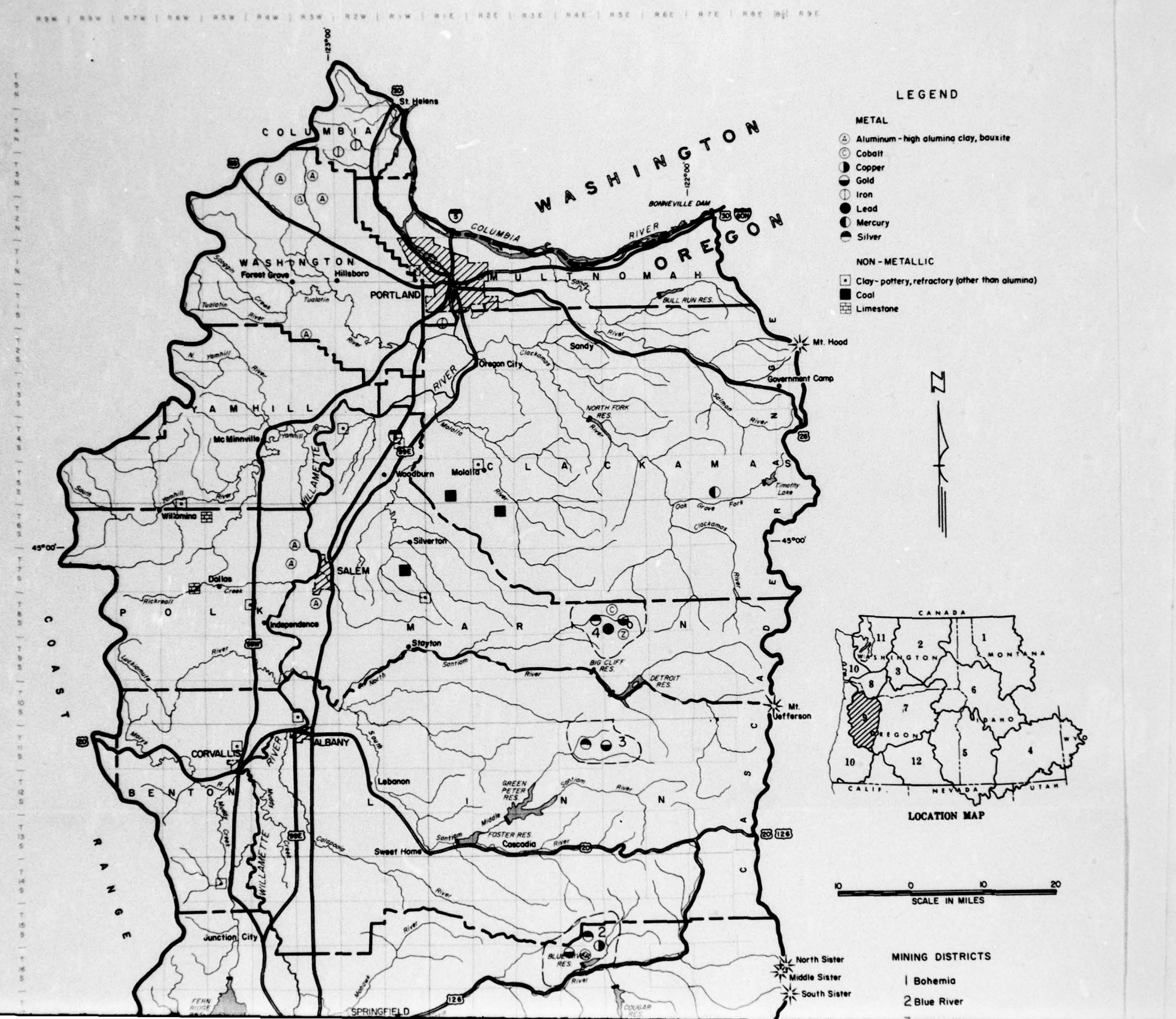
The Quartzville District is situated near the head of Quartzville Creek, a tributary to the Middle Santiam River in Linn County. The period of maximum production was from 1884 to 1896. Total production from the district was about 8,400 ounces of gold and 4,000 ounces of silver.

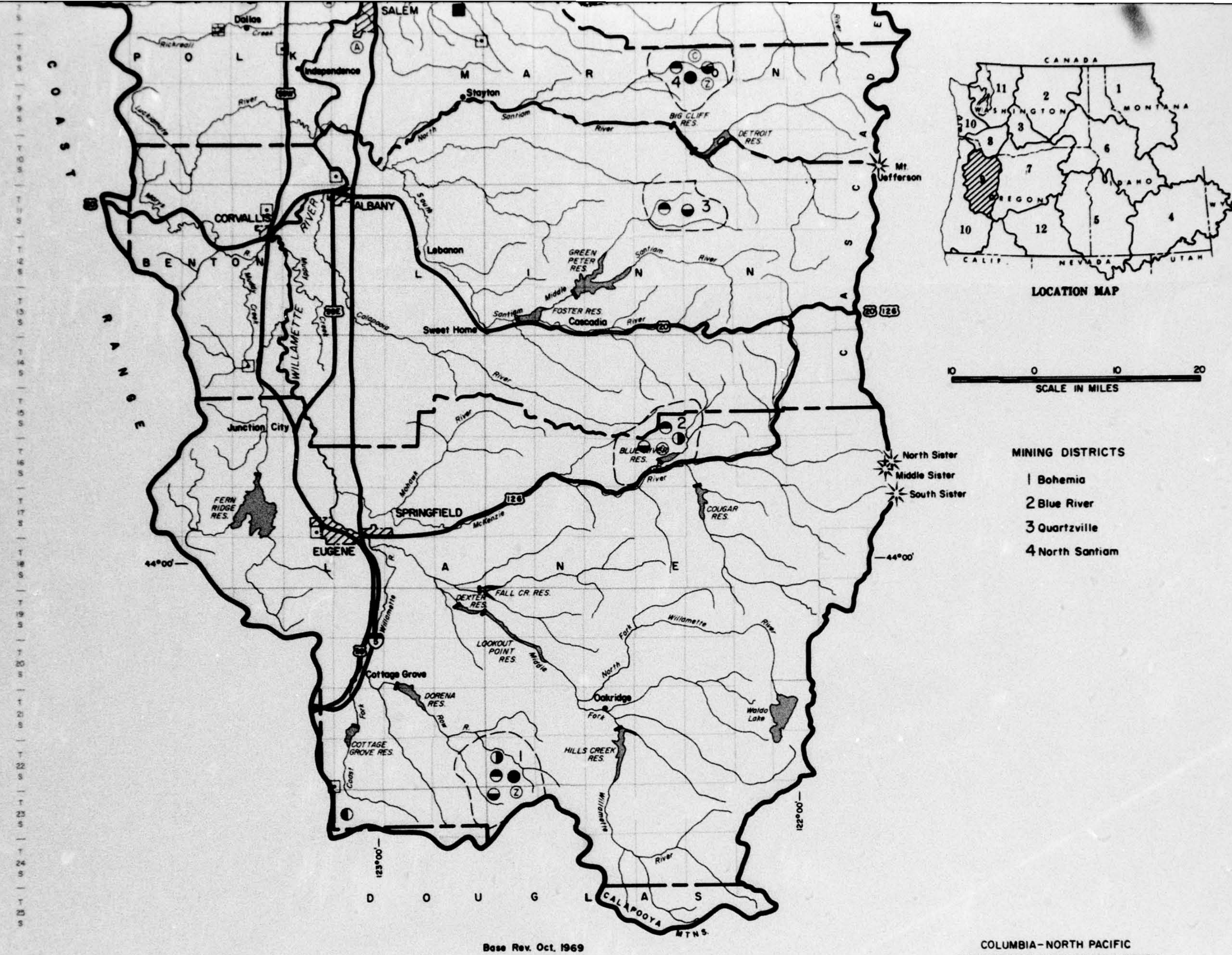
The North Santiam District is at the head of the Little North Santiam River in Marion County. Output from this district has totaled about 450 ounces of gold, 1,400 ounces of silver, 20 tons of copper, 20 tons of lead, and 55 tons of zinc. The district was discovered in 1897, and most of the production was in the period 1929-1941.

Mining districts with production plus potential gold, silver, copper, lead, and zinc, are shown in figure 41 and table 202.

The Oak Grove District is on the Oak Grove Fork of the Clackamas River, about 31 miles upstream from the town of Estacada. About 200 flasks of mercury were produced in this district in the period 1932 to 1943.

A limonite iron ore district is located near Portland. Iron ore was produced at Iron Mountain near Oswego from 1867 to 1894, and smelted in iron furnaces at Oswego. Total output was approximately 300,000 tons of ore averaging 30-40 percent metallic iron. More limonite iron deposits occur near Scappoose, near the boundary between Washington and Columbia counties. A few hundred tons have been produced from these deposits for mineral pigment. There are an estimated 4 million tons of limonite iron ore in the Scappoose deposits.


LEGEND
METAL
Aluminum - high alumina clay, bauxite
Cobalt
Copper
Gold
Iron
Lead
Mercury
Silver
NON - METALLIC
Clay - pottery, refractory (other than alumina)
Coal
Limestone
WASHINGTON
OREGON
COLUMBIA
WASHINGTON
MULTNOMAH
YAMHILL
CLACKAMAS
POLK
MARION
BENTON
LINN
CASCADE
COAST RANGE
St Helens
Forest Grove
Hillsboro
PORTLAND
Oregon City
Sandy
Woodburn
Molalla
McMinnville
Willamina
Dallas
SALEM
Silverton
Independence
Stayton
ALBANY
CORVALLIS
Lebanon
Sweet Home
Cascadia
Junction City
SPRINGFIELD
Mt. Hood
Government Camp
Mt. Jefferson
North Sister
Middle Sister
South Sister
BONNEVILLE DAM
COLUMBIA RIVER
WILLAMETTE RIVER
BULL RUN RES.
NORTH FORK RES.
BIG CLIFF RES.
DETROIT RES.
GREEN PETER RES.
FOSTER RES.
BLUE RIVER RES.
Timothy Lake
Oak Grove Fork
Clackamas River
Santiam River
Tualatin River
Yamhill River
Calapooia
Muddy Creek
Rickreall Creek
Luckiamute River
Marys River
45°00'
123°00'
122°00'
CANADA
MONTANA
WASHINGTON
IDAHO
OREGON
CALIF.
NEVADA
UTAH
LOCATION MAP
10 0 10 20
SCALE IN MILES
MINING DISTRICTS
1 Bohemia
2 Blue River



COLUMBIA–NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

MINERAL RESOURCES AND MINING DISTRICTS
WILLAMETTE, SUBREGION 9

FIGURE 41

2

Table 202 - Mining Districts, Subregion 9

Index No. Fig.	District	County	Drainage	Size of Districts - Production Plus Potential Reserves 1/ Gold	Silver	Copper	Lead	Zinc	References
1	Bohemia	Lane	Between Sharps and Brice Creeks tributaries to Row River, a tributary to the upper Willamette River	2 1/	2 1/	3 1/	3 1/	3 1/	Callaghan and Buddington, Geol. Survey Bull. 893, 1938. Taber, BuMines Inf.Circ. 7512, 1949
2	Blue River	do	Between Gate Creek and Blue River tributaries to the McKenzie River, a tributary of the Willamette River	2	3	3	-	-	Callaghan and Buddington, 1938
3	Quartzville	Linn	Head of Quartzville Creek tributary to Middle Santiam River, tributary to Willamette River.	2	2	-	-	-	do
4	North Santiam	Marion	Head of Little North Santiam River, tributary to Willamette River.	3	3	-	3	3	do

1/ Size

Index	Gold (Troy Ounces)	Silver (Troy Ounces)	Copper (Net Tons)	Lead (Net Tons)	Zinc (Net Tons)
1	100,000 - 1,000,000	500,000 - 5,000,000	10,000 - 100,000	10,000 - 100,000	10,000 - 100,000
2	10,000 - 100,000	50,000 - 500,000	1,000 - 10,000	1,000 - 10,000	1,000 - 10,000
3	1,000 - 10,000	1,000 - 50,000	1 - 1,000	1 - 1,000	1 - 1,000

Extensive ferruginous bauxite deposits occur in the northern part of the subregion. The principal deposits are in the Pumpkin Ridge-Dixie Mountain District between McKay and Dairy Creeks, tributaries to Tualatin River in Washington County, in the Salem Hills District near Salem, and near the main stem of the Willamette River. The deposits have been explored by State and Federal agencies and by private aluminum companies. No production for iron or aluminum has been made to date, but the deposits represent an important potential future source of raw material for aluminum.

Nonmetals

Nonmetallic mineral resources comprise those typically associated with sedimentary formations. They are used principally for construction materials as clay, sand and gravel, limestone, basalt, and dimension stone.

The growth of large urban and industrial centers in the subregion has created a large and growing market for construction materials; thus, production of these materials has accounted for more than 95 percent of the value of all mineral products. This urban expansion has also created some problems because of encroachment of building sites and other land uses on mineral resource localities such as sand and gravel and clay deposits.

Clay resources are widely distributed throughout the lower valley of the Willamette River. Presently, the clay produced is classified as miscellaneous and virtually all of it is used for

manufacture of building brick, tile, and other heavy clay products; some shale is used for expanded lightweight aggregate. Clay was probably mined for use in brick plants in the very early settlement. In the lower part of the Willamette Valley near Portland, loess and recent alluvium and sediments are used for clay products manufacture. Other clay sources are the early Tertiary clay and shales. Several high alumina clay deposits have been investigated for the manufacture of refractory products. The Hobart Butte deposit is on the Coast Fork, about 16 miles south of Cottage Grove. Some of this clay has been mined since 1930. The Molalla deposit is near the town of Molalla.

Principal clay-producing counties are Multnomah, Washington, Yamhill, Clackamas, Marion, Polk, and Benton. Total clay production since 1933 is approximately 3 million tons valued at $3.5 million.

Sand and gravel resources are widely distributed along the rivers and on their flood plains. The recent alluvial gravels in terraces and flood plains are generally covered by a layer of silt and sand. Sand and gravel is produced from the Willamette River channel from Corvallis to Portland, and from the river beds of the Clackamas, Pudding, Molalla, Santiam, and McKenzie Rivers. Tonnage-wise and in total value, sand and gravel production is by far the largest mineral industry in the subregion; from 1940 to 1964, production was 147 million tons valued at $145 million, which accounted for 48 percent of the total value of all minerals.

Only a number of small, impure limestone deposits occur in Clackamas, Polk, Lane, Marion, and Yamhill counties. One deposit near Dallas, in Polk County, has produced cement rock for more than 50 years, and several deposits have been worked sporadically for agricultural limestone used on local farms. Total recorded production is more than 2 million tons.

Basalt and similar volcanic rocks are exposed in widespread areas and are generally quarried for crushed rock for road material and aggregate. From 1940 to 1964, more than 48 million tons of crushed rock have been produced with every county reporting some output.

Mineral Fuels

Coal deposits in the subregion are of little economic importance. A few small coal mines in Linn, Marion, and Clackamas counties produced coal sporadically for the local market. The Waldo Hills deposit in Marion County, east of Salem, and the Madrona deposit near Wilhoit Springs, in Clackamas County, have been the major producers. The Madrona mine has produced a small

amount of coal recently for use as a soil conditioner. There is no record of total production.

Exploration drilling for oil and gas has been done in Polk, Linn, and Lane counties, but no producing wells were discovered and there has been no oil or gas produced.

Present Mineral Industry and Outlook for the Future

Metals

Gold, Silver, Copper, Lead, and Zinc Gold, silver, copper, lead, and zinc have been produced from the same districts and, in some cases, from the same deposits in the subregion. There has been no production of these metals since 1962 from any district in the subregion; however, exploration and development work have been done in the Bohemia District in 1964 and 1965. Future potential for these metals in the subregion will depend on discovery of additional ore reserves and on a favorable economic climate for production.

Mercury The Black Butte mercury mine in Lane County was reopened and production resumed in 1965 after being idle since 1957; production was about 60 flasks per month. The mine is presently in production.

Some exploration work was done in the Oak Grove mercury district in Clackamas County during 1961 and again in 1965, but no production has come from this district since 1943.

Low grade mercury ore will be mined at the Black Butte property and a few flasks might be produced in the Oak Grove District if the price of mercury remains at a high level over a period of several years. It is unlikely that future production will ever equal the more than 6,000 flasks produced in the past.

Limonite Iron Ore Limonite iron ore has not been produced for iron and steel making since the closing of the Prosser mine near Oswego in 1894. The low grade of the ore and its high moisture content make it unsuitable for use in the present steel plant at Portland.

Future potential of the limonite iron ore deposits is not favorable unless new reduction methods are perfected to provide an economic means of utilizing this type ore.

Aluminum The ferruginous bauxite deposits found in Washington and Marion counties have been extensively investigated by at least two major aluminum companies and by State of Oregon and Federal agencies. The deposits contain an estimated 50 to 75 million tons of bauxite containing about 35 percent alumina (Al_2O_3). Methods for recovery of alumina from the bauxite have been tested and proved technically feasible. A primary aluminum smelter is operated at Troutdale. The smelter consumes about 150,000 to 200,000 tons of alumina annually, all of which is currently obtained from sources outside the subregion. About 2 tons of alumina are required to produce 1 ton of aluminum metal. When other sources of alumina become less accessible and more costly, or when technological advances improve the economic feasibility of recovery, the ferruginous bauxite deposits will be mined.

Nonmetals

Clay Clay production in the subregion in 1965 came from Benton, Polk, Yamhill, Washington, Multnomah, and Clackamas counties. The total clay production in 1964 was about 140,000 tons, all of which was classified as miscellaneous clays used predominantly for making brick and draintile. Principal production in recent years has come from Washington, Multnomah, and Yamhill counties, with shale being processed for lightweight aggregate at two plants in Washington County. Eight brick and tile plants were operating in the subregion in 1964.

Adequate reserves of clay are usually available so that future production will doubtless follow past trends, with increased output dependent on availability of markets within the marketing range of the operations.

Sand and Gravel Sand and gravel is the leading mineral industry in the subregion. In addition to the large amount used in construction in towns and cities, large tonnages are used by the Corps of Engineers and other construction agencies in dam construction and road building. Commercial sand and gravel production was about 5.8 million tons annually over the 6-year period 1959-1964, while noncommercial production fluctuated between 8.7 million and 2.3 million tons over the same period. In 1964 there were 99 active sand and gravel operations with output of 9.1 million tons. Table 203 shows production for period 1959-64.

Sand and gravel resources are generally adequate for future demand except in local areas where other land uses such as urban expansion and urban zoning have discouraged or prohibited mining operations. Removal of sand and gravel operations to deposits at

greater distance from markets results in higher transportation costs and, eventually, higher prices to the consumer.

Table 203 - Sand and Gravel Production, Subregion 9

Year	Building and structural		Road material		Fill	
	Short tons	Value (dollars)	Short tons	Value (dollars)	Short tons	Value (dollars)
1959	6,980,656	3,966,102	6,481,347	6,728,395	192,024	159,750
1960	5,683,841	4,752,210	5,386,357	5,899,941	707,381	470,700
1961	1,992,124	2,226.489	3,944,298	4,500,190	276,431	231,143
1962	2,522,557	2,860,385	4,006,088	4,641,311	1,247,522	584,460
1963	2,621,440	3,281,484	4,794,546	5,991,540	625,672	512,902
1964	2,761,000	3,684,000	5,418,000	7,566,000	519,000	434,000

Year	Railroad ballast		Other		Total	
	Short tons	Value (dollars)	Short tons	Value (dollars)	Short tons	Value (dollars)
1959	1/	1/	112,932	138,340	13,766,959	10,992,587
1960	1/	1/	701,754	394,550	12,479,333	11,517,401
1961	1/	1/	196,713	197,498	6,409,566	7,155,320
1962	1/	1/	263,366	283,797	8,039,533	8,369,953
1963	5,000	10,800	250,045	500,550	8,296,703	10,297,276
1964	56,000	41,000	317,000	529,000	9,071,000	12,254,000

1/ Included with Other to avoid disclossing individual company confidential data.

Cement and Lime Cement is currently manufactured by the Oregon Portland Cement Company plant at Oswego, Clackamas County. Limestone was formerly quarried near Dallas in Polk County, but presently is imported from Texada Island, B. C. Plant capacity is rated at 2 million barrels of cement per year, but a modernization program will raise capacity to 3.5 million barrels.

Lime is produced by the Ash Grove Lime and Portland Cement Company at Portland from limestone imported from British Columbia. Another lime producer is the Pacific Carbide and Alloys Co. in Portland, for manufacture of calcium carbide.

Stone Most of the stone produced is crushed basalt used predominantly for road material and aggregate. Crushed stone is produced in every county. Yearly production fluctuates widely due to intermittent or abnormal demands for use in dam construction and bank protection. A small tonnage of dimension building stone is produced in Multnomah and Marion counties. Table 204 shows stone production for the period 1959-64.

Table 204 - Stone Sold or Used by Producers, Subregion 9

Year	Building (dimension) Short tons	Building (dimension) Value (dollars)	Concrete and roadstone Short tons	Concrete and roadstone Value (dollars)	Railroad ballast Short tons	Railroad ballast Value (dollars)
1959	653	8,700	1,808,242	2,355,138	1/	1/
1960	937	19,240	3,458,519	3,355,596	1/	1/
1961	872	9,104	3,115,786	3,529,787	1/	1/
1962	1/	1/	2,032,968	2,399,883	-	-
1963	1,550	14,000	3,286,529	3,832,272	75,137	85,175
1964	1,281	11,820	3,481,433	3,534,620	1/	1/

Year	Riprap and fill Short tons	Riprap and fill Value (dollars)	Other Short tons	Other Value (dollars)	Total Short tons	Total Value (dollars)
1959	1,903,903	1,198,824	488,532	526,025	4,201,330	4,088,687
1960	1,183,722	867,971	362,968	377,349	5,006,146	4,620,156
1961	4,358,488	4,496,254	306,020	285,783	7,781,166	8,320,928
1962	7,333,268	6,556,021	192,302	212,845	9,558,538	9,168,749
1963	3,692,719	3,697,739	270,225	323,437	7,326,160	7,952,623
1964	1,781,990	1,267,437	111,977	101,170	5,376,681	4,915,047

1/ Included with Other to avoid disclosing individual company confidential data.

SUBREGION 10
COASTAL

ABSTRACT

The Coastal Subregion extends along the margin of the Pacific Ocean from the Straits of Juan de Fuca south along the west slope of the Olympic Peninsula and Oregon Coast Range to the California State line. In southern Oregon, the boundary swings east to the terminal crest of the Cascade Range and includes the Umpqua and Rogue drainage basins. In Washington State the subregion includes the Chehalis River Basin. However, this area is not highly contrasting in climate and soils.

The land resource consists of two main areas, the coastal margin area and the Rogue-Umpqua River Basin areas.

The coastal margin area is characterized by two physiographic and use areas. The dominant physical feature is the mountainous uplands with narrow, deeply entrenched valleys and steep forest covered slopes. It extends the full length of the subregion and is quite uniform in precipitation from 80 to well over 100 inches that fall at very low intensity (less than .5 inch per hour sustained over 2-hour periods) during an extended period of time. Temperatures do not fluctuate much from January to July but generally maintain a cool average throughout the year. The major use is forest land. Problems of use are related to steep slopes and maintaining soil stability after prolonged wet periods.

The contrasting topographic and use area on the coastal margin between the mountains and the coast is the footslopes, fans, terraces, and bottomlands that occur on the narrow coastal plain and extend inland along main rivers and tributaries. While much of this area is still covered with forest and is used as forest land, practically all of the limited cropland is concentrated in this part of the landscape. Crops are generally limited to hay-pasture crops or special crops such as bulbs and cranberries. Problems of use relate to soil wetness, soil acidity, and the low level of base saturation. There is some water erosion on moderate and strong slopes and wind erosion is severe in areas of beach sand.

The Umpqua and Rogue basin areas have a somewhat different physiography and land use from the coastal margin area. The dominant physical feature of these basins is the high mountainous upland with steep slopes and forest cover. However, the average precipitation generally ranges from 20 to 70 inches annually, with colder winters

and warmer summers. Problems of use relate to rocky and erosive soils on strong and steep slopes.

The low mountains and foothills are unique in the Umpqua and Rogue River basins. Most of the rangeland in Subregion 10 is on the foothills and low mountains. The soils are generally uniform but have a number of highly contrasting soil areas. The sandy soils formed in material influenced by granitic type rocks occur in this area; also the very fine clay textured grumusolic soils and the infertile soils influenced by serpentine-olivine rock. Some of the alluvial fans and terraces in this general area are used for cropland; however, in spite of the cropland uses, the major practical use is forest land or rangeland. Problems of use generally relate to erosion on strong and steep slopes; however, on the small segregated soil areas referred to above, the problems of use vary from highly erosive soils influenced by granitic rock, to the clayey soils influenced by basic tuffs, to the upset nutrient level of soils influenced by serpentine-olivine rock.

The footslopes, fans, terraces, and bottomlands on the Umpqua and Rogue rivers and along the major tributaries are generally used for cropland and rangeland. The soils formed in colluvium and alluvium are mostly deep, but frequently are gravelly and cobbly or sandy or have very fine clay textures, and in at least one area cemented hardpans have developed. The range in climatically adapted crops is particularly wide on the cropland on this area. The pear orchards of the Bear Creek Valley and the diverse row and specialty crops along the Rogue River are especially well known. Problems of use in this general area relate to the presence of coarse fragments in the soil, small areas of cemented and partially cemented hardpans, clayey textured soils, and, in a few isolated places, an upset nutrient balance restricts the cropland use. Climate restricts somewhat the range of adapted crops.

Most of the metals produced in Subregion 10 have come from Jackson, Josephine, and Douglas counties, Oregon, principally in the Rogue River drainage. These have been among the most productive mining regions in Oregon in the past, although, output largely is limited at present to nickel production near Riddle in Douglas County. The Nickel Mountain deposit has produced more than 150,000 tons of contained nickel since 1954 and is the only nickel producer in the Nation. Currently, output is at the rate of about 12,000 to 15,000 tons of nickel annually.

The subregion has been the most important producer of mercury in the Columbia-North Pacific Region. The principal output came from the Bonanza mine near Sutherlin in Douglas County, with a record of nearly 40,000 flasks. Several hundred flasks have come from mercury mines in Josephine and Jackson counties. Current output is very small.

In the early history of Oregon, Jackson and Josephine counties were notable for their output of gold, mostly from placer deposits and later from rich veins or pockets found in lode deposits. There is little current activity.

The total watershed area consists of about 99 percent land and 1 percent water. Table 205 shows the land, water, and total watershed acreages by states and counties. Except for this table, only areas of land will be recorded in the following discussion.

Table 205 - Areas by State and County, Subregion 10, 1967

State and County	Water Area Sq.Mi.	Water Area Acres	Land Area[1/] Sq. Mi.	Land Area[1/] Acres	Total Area Sq. Mi.	Total Area Acres
Oregon						
Benton	0.3	200	181.6	116,200	181.9	116,400
Clatsop	23.0	14,700	820.0	524,800	843.0	539,500
Columbia	11.0	7,000	255.6	163,600	266.6	170,600
Coos	15.9	10,200	1,611.1	1,031,100	1,627.0	1,041,300
Curry	7.6	4,900	1,534.7	982,200	1,542.3	987,100
Douglas	23.5	15,100	4,958.0	3,173,100	4,981.5	3,188,200
Jackson	4.2	2,700	2,568.2	1,643,600	2,572.4	1,646,300
Josephine	0.4	200	1,620.7	1,037,300	1,621.1	1,037,500
Klamath	0.0	0	225.8	144,500	225.8	144,500
Lane	7.2	4,600	1,067.6	683,300	1,074.8	687,900
Lincoln	12.8	8,200	970.6	621,200	983.4	629,400
Polk	0.0	0	98.6	63,100	98.6	63,100
Tillamook	24.3	15,500	1,103.7	706,400	1,128.0	721,900
Washington	0.1	100	85.0	54,400	85.1	54,500
Yamhill	0.0	0	62.0	39,700	62.0	39,700
Total	130.3	83,400	17,163.2	10,984,500	17,293.5	11,067,900
Washington						
Clallam	33.3	21,300	1,160.3	742,600	1,193.6	763,900
Cowlitz	0.0	0	08.0	5,100	08.0	5,100
Grays Harbor	11.1	7,100	1,908.7	1,221,500	1,919.8	1,228,600
Jefferson	0.0	0	1,123.5	719,100	1,123.5	719,100
Lewis	0.0	0	766.6	490,600	766.6	490,600
Mason	0.6	400	230.2	147,300	230.8	147,700
Pacific	61.9	39,600	835.6	534,800	897.5	574,400
Thurston	1.3	800	310.4	198,700	311.7	199,500
Wahkiakum	2.8	1,800	15.6	10,000	18.4	11,800
Total	111.0	71,000	6,358.9	4,069,700	6,469.9	4,140,700
Total Subregion	241.3	154,400	23,522.1	15,054,200	23,763.4	15,208,600

1/ The term "land" is defined to include all water bodies under 40 acres and streams under one-eighth mile in width.
Source: U.S.D.A. Conservation Needs Inventory adjusted to U.S. Census.

LAND

Factors of major importance to the land resource are: the ownership status, the soils, and the present use. The combination of these factors greatly influences the present and future utilization of the land resource.

Land Ownership

Subregion 10 contains slightly over 15.0 million acres. Private ownerships make up the single largest group of land owners with 7.5 million acres or 50 percent of the total land area. The Federal Government owns over 6.1 million acres or 41 percent of the total. State, county, and municipal ownerships make up the balance.

Over 3.5 million acres of the public lands are national forest. Another 1.8 million acres are Public Domain or revested Oregon and California railroad grant lands. Nearly 600,000 acres are in National Parks. About 28,000 acres are other Federal holdings in the Departments of the Interior and Defense. Almost 1.5 million acres are owned by state, county, and municipal governments. About 170,000 acres are Indian Reservations.

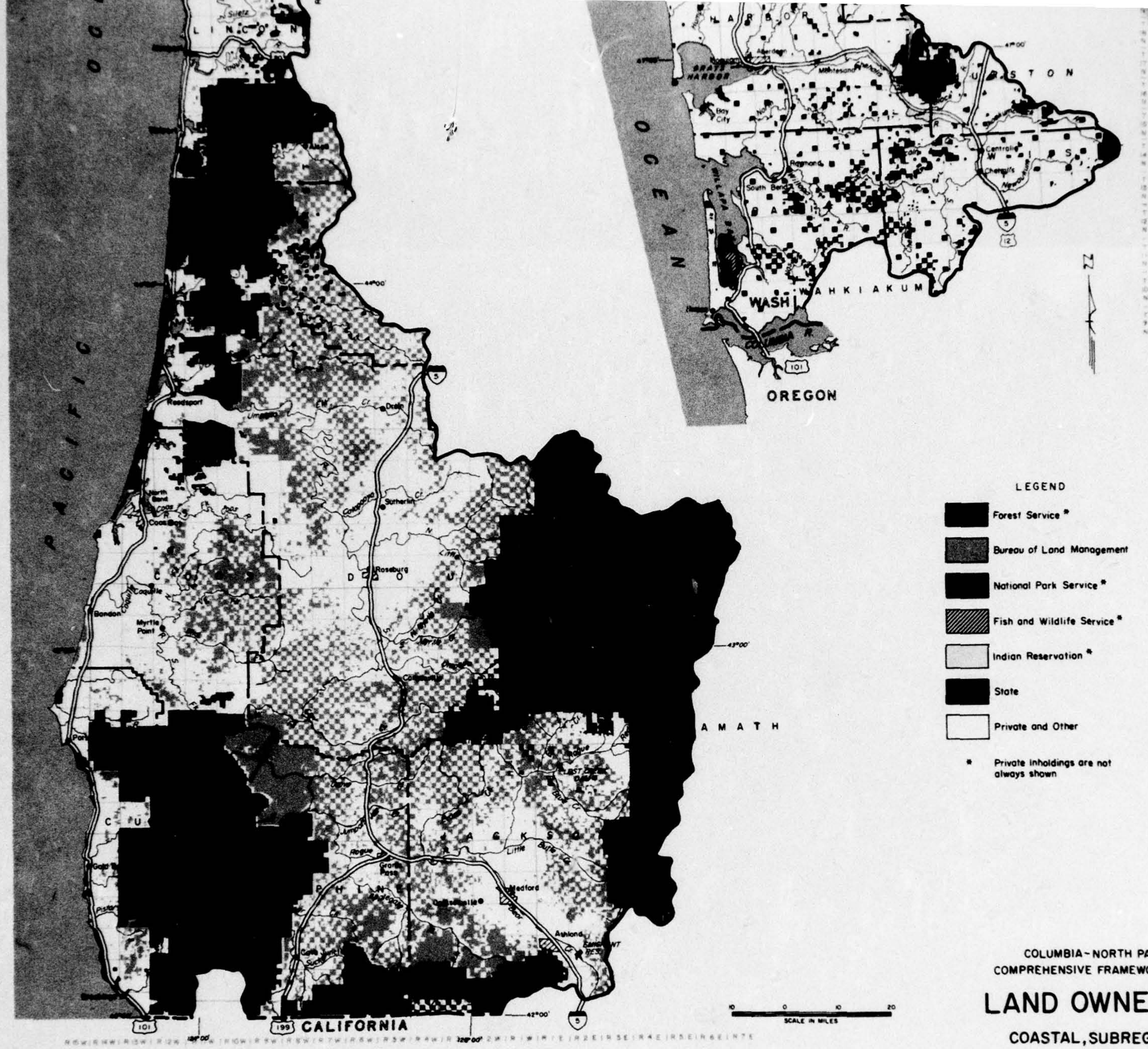
Table 206, Land Ownership, and figure 42, Land Ownership Map, show this information in detail.

Table 206 - Land Ownership Acreage, Subregion 10, 1965

Administering Agencies	Washington	Oregon (1,000 acres)	Total
Department of Agriculture			
Forest Service	335.8	3,181.9	3,517.7
Other Agriculture	-	-	-
Subtotal	335.8	3,181.9	3,517.7
Department of the Interior			
Bureau of Land Management	2.0	1,836.3	1,838.3
Bureau of Indian Affairs 1/	167.6	-	167.6
National Park Service	514.9	64.4	579.3
Fish & Wildlife Service	8.5	.2	8.7
Bureau of Reclamation	-	8.7	8.7
Other Interior	.1	.3	.4
	693.1	1,909.9	2,603.0
Department of Defense	1.4	6.3	7.7
Other Federal	.5	2.4	2.9
Federal Subtotal	1,030.8	5,100.5	6,131.3
State	553.6	675.3	1,228.9
County	41.0	134.8	175.8
Municipal	16.3	39.7	56.0
Public Non-Federal Subtotal	610.9	849.8	1,460.7
Total Public	1,641.7	5,950.3	7,592.0
Total Private	2,428.0	5,034.2	7,462.2
Grand Total	4,069.7	10,984.5	15,054.2

1/ Private lands held in trust by the Federal Government.
Source: General Services Administration Real Property Owned by the United States as of June 30, 1965, adjusted by the Land and Minerals Work Group.


WASHINGTON
OREGON
CLATSOP
COLUMBIA
Seaside
Vernonia
Tillamook
LINCOLN
Siletz
RANGE
Reedsport
Umpqua
Elk Cr.
Drain
PACIFIC OCEAN
CANADA
WASHINGTON
STRAIT OF JUAN DE FUCA
MOUNTAINS
GRAYS HARBOR
MASON
THURSTON
LEWIS
PACIFIC
WAHKIAKUM
WASH
Aberdeen
Montesano
Bay City
Raymond
South Bend
WILLAPA BAY
Centralia
Chehalis
COLUMBIA R.
OREGON
LOCATION MAP
Base Rev. Oct. 1969
CANADA
MONTANA
IDAHO
NEVADA
UTAH
CALIF
123°00'
124°00'
48°00'
47°00'
46°00'
45°00'
44°00'
LEGEND



COLUMBIA - NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

LAND OWNERSHIP

COASTAL, SUBREGION 10
1968

FIGURE 42

2

Soils

Figure 43, Soil Associations Map, shows the location and relative extent of each soil association. The associations are numbered in a general relationship to the position in the landscape. Thus, bottomlands and low terraces have the lowest numbers and alpine areas have the highest. The name of each association relates to the soil series representing general kinds of soil that are most extensive in the landscape. Wherever possible, established soil series are used in the name; however, where the soil series do not have classification status, the soil series name is not recorded. Generally up to 15 percent of any soil association in known areas may consist of inclusions of soils other than those identified. Such inclusions may be similar soils or they may be highly contrasting. However, in many high, mountainous areas where detailed knowledge about the area is incomplete, extensive areas are included within delineations and inclusions of other soils may exceed 15 percent.

Table 207 contains information about each soil association shown on the map. The symbol listed in the second column on the table is the same symbol shown on the soil association map.

The table is organized to show land characteristics and the characteristics, qualities, and some interpretations of soil series representing the dominant and the contrasting kinds of soil in each association. The first six columns show some general land characteristics for each soil association. The next 11 columns show characteristics (permanent soil facts) of individual key soil series that represent dominant and contrasting soils. The following four show qualities inferred from the characteristics of these soils and the last four columns show interpretations concerning agricultural use based upon the foregoing soil characteristics and qualities. All of the representative soil series listed have status in classifications. A blank space in the soil series column indicates that the soil series name has no classification status.

The "soil groups" column contains soil associations that have broad similarities in some important characteristics, frequently identified with a position on the landscape.

The "percentage of association" column shows the extent of each soil in an association. Differences of the total soil percentage in each association from 100 percent are inclusions of other soils and land types. For example, soil association 42 lists a total of 50 percent. Knowledge of this area is limited so 50 percent of the area consists of inclusions of soils that have not been defined.

Terms listed for permeability of water through the subsoil and permeability of substratum are:

Very rapid: Over 10 inches per hour.
Rapid: 5 to 10 inches per hour.
Moderately rapid: 2.50 to 5 inches per hour.
Moderate: 0.8 to 2.5 inches per hour.
Moderately slow: 0.2 to 0.8 inches per hour.
Slow: 0.05 to 0.2 inches per hour.
Very slow: Less than 0.05 inches per hour.

Terms listed for total available water-holding capacity are:

Low: Less than 6 inches in profile.
Medium: 6 to 10 inches.
High: More than 10 inches in profile.

The irrigated capability subclasses are an interpretation of limitations and hazards of using only presently irrigated lands. Many areas not presently irrigated may be potentially irrigable but are not included in this classification.

A dash indicates that a column does not apply or there is insufficient data to complete it.

Soils are defined in table 207 and the extent of each soil association is recorded in table 208. Almost 50 percent of the soils are formed in residuum-colluvium from sedimentary bedrock. Over 63 percent of the soil associations consist of deep and very deep soil profiles. Over half of the soil associations are moderately permeable in the substrata. Over 35 percent of the soils have little or no coarse fragments in the profile; minor amounts (8 percent) of soils are formed in glacial materials and (6 percent) influenced by ash or pumice.

Table 208 shows the estimated acreage and proportionate extent of the soil associations by states.

Interpretations and Evaluation

Table 209 relates the land capability classes to the Land Capability Map, figure 3. It must be realized that the Land Capability Map is highly generalized and a specific capability class on table 209 may not be shown. To determine the land capability of any particular area, refer to the soil association symbols listed in the second column of the table and then locate the area of that symbol on the Soil Association Map, figure 43. Table 209 also shows the acreage and extent of the dominant land capability class for practical segments of the landscape.

LEGEND REVISED 1970

LEGEND

Soil Associations Map Symbol * | Name of Association

Generally silty and sandy soils formed in alluvial sediments on bottomlands and low terraces.

1 Coquille - Knappa
2 Hoh - Bogachiel
3 Quillayute - Knappa
4 Chehalis - Cloquato
5 Ruch - Newberg

Generally silty and sandy soils with coarse fragments formed in glacial materials on terraces, plains and mountains.

6 Hoquium - Rockland
7 Shelton - Grove
8 Spanaway - Alderwood
9 Alderwood - Everett
10 Elwha - Clallam
11 Dominantly Haplumbrepts

Generally clayey soils formed in materials mixed with residuum-colluvium from sedimentary bedrock on foothills and uplands.

12 Haplohumults
13 Vader - Knappa
14 Steiwer - Sutherlin
15 Willakenzie
16 Josephine - Ruch

Generally silty or sandy soils formed in wind deposited or wind worked sediments on hilly uplands.

17 Netarts - Westport
18 Cascade - Goble

Generally silty soils formed in materials mixed with rocky residuum-colluvium from basic rock types on plateaus, canyons and mountains.

19 Kerby - Abegg
20 Germany - Olympic
21 Nekia - Jory
22 McCully - Kinney
23 Agate - Rockland
24 Climax
25 Carney - Coker
26 Klickitat-Hembre
27 Dominantly Haploxerults
28 Dominantly Haploxerults
29 Dominantly Cryumbrepts

Generally sandy soils formed in materials mixed with volcanic ash or pumice on terraces, foothills, plateaus and mountains.

30 Bear Prairie - Loper
31 Wilkeson - Melbourne
32 Steiger - Crater Lake
33 Cinebar - Olympic
34 Dominantly Cryumbrepts

Generally silty soils formed in materials mixed with gravelly residuum-colluvium from sedimentary bedrock on mountains.

35 Orford - Sebastian
36 Josephine - Cornutt
37 Dominantly Haplumbrepts
38 Astoria - Melby
39 Melby - Olyic
40 Dominantly Haplohumults
41 Astoria - Trask
42 Astoria - Klone
43 Rockland - Rough Mountainous

Generally sandy soils formed in materials mixed with rocky residuum-colluvium from acidic rock types on terraces, foothills and mountains.

44 Siskiyou - Barron
45 Snowlin - Prong

Symbols are non-conotative and
subregion. To compare delineations
another refer to the name of the Soil

NOTE: The Soil Association name m
not fit the Soil Associations Group d
iation name is based on dominant ser
series may be only 30 percent of the
clayey textured soil series may be in
described as generally silty and sand

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D

ssociation

oils formed in alluvial
nd low terraces.

Knappa
chiel
- Knappa
Cloquato
wberg

oils with coarse fragments form-
erraces, plains and mountains.

Rockland
Grove
- Alderwood
- Everett
allam
Haplumbrepts

ned in materials mixed with
dimentary bedrock on foot-

lts
appa
Sutherlin
e
- Ruch

ils formed in wind deposited
on hilly uplands.

Westport
Goble

d in materials mixed with
from basic rock types on
ntains.

begg
- Olympic
ory
- Kinney
ockland

Coker
Hembre
y Haploxerults
y Haploxerults
y Cryumbrepts

ed in materials mixed with
terraces, foothills, plateaus

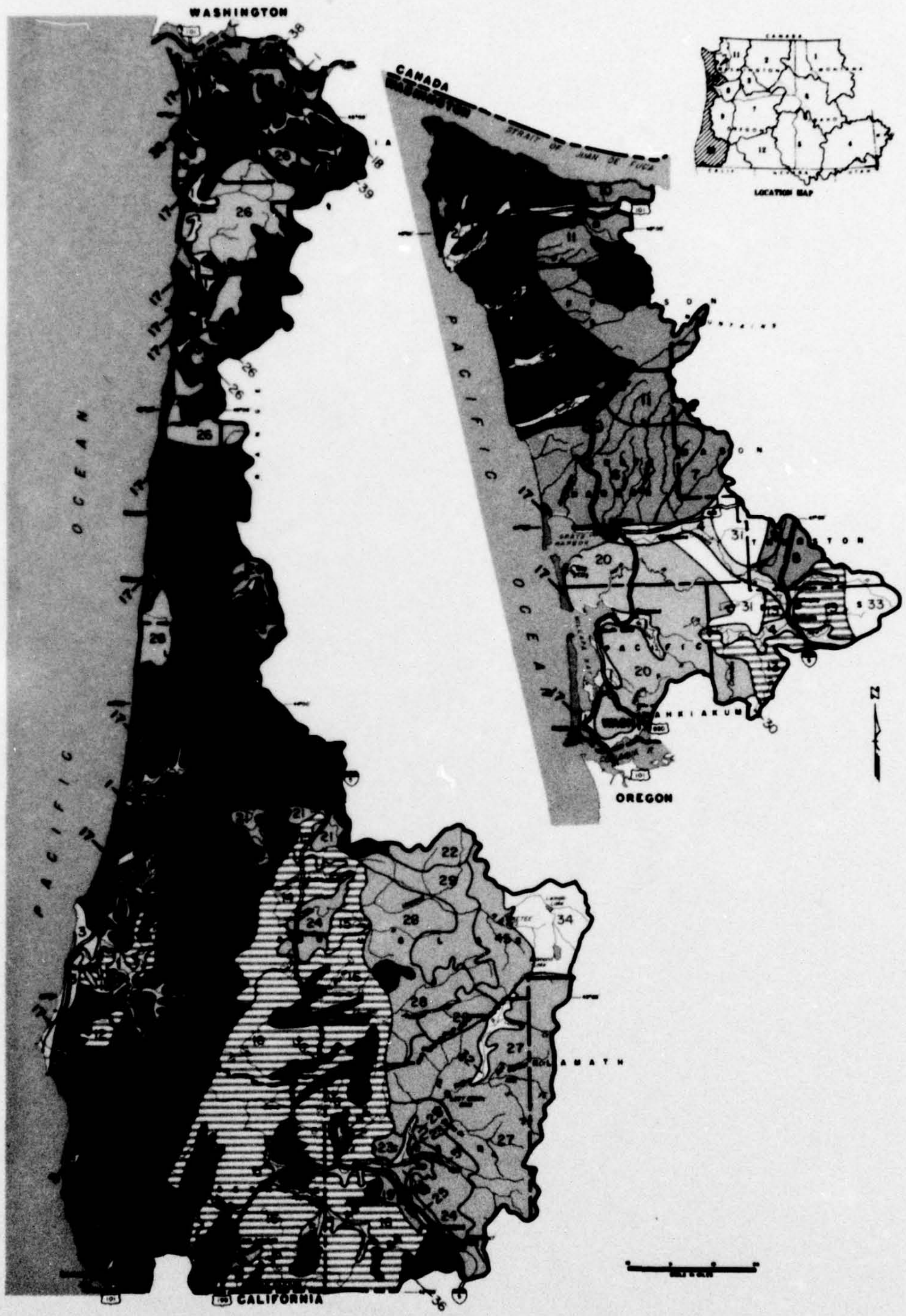
rie - Loper
- Melbourne
Crater Lake
- Olympic
ly Cryumbrepts

d in materials mixed with
um from sedimentary bedrock

Sebastian
- Cornutt
ly Haplumbrepts
Melby
Olyic
ly Haplohumults
Trask
Klone
- Rough Mountainous

ed in materials mixed with
from acidic rock types on
untains.

- Barron
- Prong



* *Symbols are non-conotative and consistent only within each subregion. To compare delineations from one subregion to another refer to the name of the Soil Association.*

NOTE: The Soil Association name may include a series that does not fit the Soil Associations Group description. The Soil Association name is based on dominant series. The dominant of five series may be only 30 percent of the Soil Association. Thus a clayey textured soil series may be included in a group accurately described as generally silty and sandy in texture.

COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

SOIL ASSOCIATIONS

COASTAL, SUBREGION 10

FIGURE 43

Table 207 - Characteristics and Qualities of Representative Soils, Sub

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage 3/ of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile De
Very deep acid soils over loamy and clayey subsoils on nearly level slopes.	1	0-300	70-120	180-250	Cropland (cereals, hay and pasture)-dryland (bulbs, berries, hay and pasture)-irrigated	Fluventic Haplaquepts	Fine-silty, mixed, acid, mesic	Coquille	25	Bottom-lands and tidal flats	Alluvium	Silt loam	Silty clay loam	None	--	60"+
						Pachic Haplumbrepts	Fine-silty, mixed, mesic	Knappa	20	Terraces	Alluvium	Silt loam	Silty clay loam	None	--	60"+
					Forest land	Fluventic Haplumbrepts	Fine-silty, mixed, mesic	Nehalem	15	Flood plains	Alluvium	Silt loam	Silt loam or silty clay loam	None	--	60"+
						Histic Humaquepts (Typic)	Fine, mixed, acid, mesic	Clatsop	10	Tidal flats	Alluvium	Silty clay loam	Silty clay	None	--	10-20" over clayey material
						Fluventic Tropaquepts	Fine, mixed, non-acid, mesic	Bayside	10	Terraces	Alluvium	Silty clay loam	Silty clay & silty clay loam	None	--	20-36" over clayey material
	2	0-100	80-160	100-150	Forest land 4/	Typic Udifluvents	Coarse-loamy, mixed, acid, mesic	Hoh	35	Terraces	Alluvium	Silt loam	Very fine sandy loam (loamy fine sand below 30")	None	--	60"+
					Cropland (pasture, silage & cereals)-5% irrigated	Typic Udifluvents	Coarse-loamy, mixed, acid, mesic	Bogachiel	30	Terraces	Alluvium	Fine sandy loam	Very fine sandy loam to silt-loam	None	--	60"+

Table 207 - Characteristics and Qualities of Representative Soils, Subregion 10[1/]

Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Range of: Major Capability Subclass: Irrigated[6/]	Major Soil Problems	Suitable Land Treatment and Structures
Bottom-lands and tidal flats	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderate	Slow	Very poor	Medium and high	IIIw IVw	--	Tidal overflow; wetness; acid soil	Diking; pumping; drainage; soil amendments; pastureland management.
Terraces	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderate	Moderate	Good	High	IIc IIe IIIe	IIc IIe IIIe	Erosion; acid soil	Cross-slope operations; residue mgmt; cropping sequence; soil amendments; irrigation mgmt.
Flood plains	Alluvium	Silt loam	Silt loam or silty clay loam	None	--	60"+	Moderate	Moderate	Good	High	IIw IIc	IIw IIc	Flooding; acid soil	Flood protection; soil amendments; irrigation mgmt; pastureland mgmt.
Tidal flats	Alluvium	Silty clay loam	Silty clay	None	--	10-20" over clayey material	Slow	Very slow	Very poor	Medium	IVw	--	Tidal overflow; wetness; acid soil	Diking; pumping; drainage; soil amendments; pastureland management
Terraces	Alluvium	Silty clay loam	Silty clay & silty clay loam	None	--	20-36" over clayey material	Moderately slow	Slow	Somewhat poor	Medium and high	IIIw IVw	--	Wetness; acid soil; occasional fresh water flooding during high tides	Drainage; soil amendments; pastureland management
Terraces	Alluvium	Silt loam	Very fine sandy loam (loamy fine sand below 30")	None	--	60"+	Moderately rapid	Very rapid	Good and Moderately good	Medium	IIIs	IIIs	Acid soil; flooding	Forest land management; soil amendments; flood protection; irrigation management
Terraces	Alluvium	Fine sandy loam	Very fine sandy loam to silt-loam	None	--	60"+	Moderately rapid and moderate	Moderately rapid and moderate	Good	High	IVs	IVs	Acid soil; flooding	Forest land management; soil amendments; flood protection; irrigation management

2

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage of Assn. 3/	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth	Permeab Sub
Moderately deep to very deep, acid soils with fine loamy and sandy subsoils on nearly level and gentle slopes.	3	20-50	90-95	180	Cropland (pasture)-30% irrigated	Typic Dystrandepts	Ashy, mesic	Quillayute	25	Terraces	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderat
					Forest land	Pachic Haplumbrepts	Fine-silty, mixed, mesic	Knappa	25	Terraces	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderat
						Typic Haplumbrepts	Coarse-loamy, mixed, mesic	Ferrelo	20	Terraces	Alluvium	Silt loam and loam	Loam	None	--	40-60" over semi-cemented lenses	Moderat
						Typic Sideraquods	Sandy, mixed, mesic, ortstein	Blacklock	10	Basins	Alluvium & aeolian	Sandy loam	Loamy sand	None	--	20-40" over cemented ortstein	Rapid
						Fluventic Umbric Dystrochrepts	Sandy, mixed, mesic	Gardiner	3	Bottomlands	Alluvium	Fine sandy loam	Loamy fine sand	None	--	60"+	Rapid
						Typic Umbraqualts	Clayey, mixed, mesic	Hebo	2	Terraces and bottomlands	Alluvium	Silty clay loam	Clay	None	--	10-20" over clayey material	Very sl
Very deep soils with loamy and clayey subsoils on nearly level slopes.	4	0-100	45-90	120-180	Forest land	Cumulic Ultic Haploxerolls	Fine-silty, mixed, mesic	Chehalis	30	Bottomlands	Alluvium	Silty clay loam	Silty clay loam	None	--	60"+	Moderat
					Cropland (root crops, potatoes, sweet corn, green peas, pasture & hay) - 50% irrigated	Cumulic Ultic Haploxerolls	Coarse-silty, mixed, mesic	Cloquato	30	Bottomlands	Alluvium	Silt loam	Silt loam	None	--	60"+	Moderat

Table 207 - Continued

pe	Soil Characteristics						Soil Qualities and Interpretations							
				Coarse Fragments						Total Available Water-holding Capacity	Range of: Major Capability Subclass			
	Parent Material	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class		Dryland	Irrigated[6/]	Major Soil Problems	Suitable Land Treatment and Structures
s	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderate	Moderate	Good	High	IIe IIIe	IIe IIIe	Erosion; acid soil	Pastureland mgmt; soil amendments; irrigation management
s	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderate	Moderate	Good	High	IIc IIe IIIe	IIc IIe IIIe	Erosion; acid soil	Pastureland management; soil amendments; irrigation management
s	Alluvium	Silt loam and loam	Loam	None	--	40-60" over semi-cemented lenses	Moderate	Slow	Good	Medium and low	IIIe IVe VIe	IIIe	Erosion; acid soil	Pastureland mgmt; soil amendments; irrigation management
	Alluvium & aeolian	Sandy loam	Loamy sand	None	--	20-40" over cemented ortstein	Rapid	Impervious	Very poor	Low	VIw	--	Wetness; perched water table	Pastureland mgmt; drainage; soil amendments; fertilization; irrigation mgmt; specialty crops
-	Alluvium	Fine sandy loam	Loamy fine sand	None	--	60"+	Rapid	Rapid	Good	Low	IIs IIw IVw	IIs IIw IVw	Erosion; flooding; acid soil	Pastureland mgmt; flood protection; soil amendments; irrigation mgmt.
es ttom-	Alluvium	Silty clay loam	Clay	None	--	10-20" over clayey material	Very slow	Very slow	Poor	Medium and low	IVw	IVw	Wetness; clayey profile; acid soil	Drainage; soil amendments; pastureland mgmt; irrigation mgmt.
-	Alluvium	Silty clay loam	Silty clay loam	None	--	60"+	Moderate	Moderately slow	Good	High	I IIw	I IIw	Wetness; floods in some areas	Forest land mgmt; drainage; flood protection; irrigation mgmt; residue mgmt; cropping sequence
-	Alluvium	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	I IIw	I IIw	Wetness; floods in some areas	Forest land mgmt; drainage; flood protection; irrigation mgmt; residue mgmt; cropping sequence

2

Table 207 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage 3/ of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	P
	5	800-2,500	20-40	120-180	Cropland (pasture, hay, grass seed, hops, corn, fruit orchards and row crops)-irrigated (pasture & hay)-dryland	Ultic Haploxeralfs	Fine-loamy, mixed, mesic	Ruch	25	Fans	Alluvium	Loam	Clay loam	None	--	60"+	Mo
						Fluventic Haploxerolls	Coarse-loamy, mixed, mesic	Newberg	20	Flood plains	Alluvium	Fine sandy loam	Sandy loam	Gravel	0-15 in profile	60"+	Ra
						Cumulic Ultic Haploxerolls	Fine, mixed, mesic	Abiqua	10	Bottomlands	Alluvium	Silty clay loam	Silty clay	None	--	60"+	Mo sl
						Typic Xerorthents	Sandy-skeletal, mixed, mesic	Camas	10	Flood plains	Alluvium	Sandy loam	Very cobbly sand	Stones, cobbles & gravel	35-60 below top 10" in profile	10-20" over gravel	Ve
						Cumulic Haploxerolls	Coarse-loamy, mixed, mesic	Evans	10	Flood plains	Alluvium	Loam	Loam	None	--	60"+	Mo
						Cumulic Ultic Haploxerolls	Fine-silty, mixed, mesic	Chehalis	5	Bottomlands	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Mo
Shallow to moderately deep, acid soils with loamy subsoils on nearly level to moderate slopes.	6	0-3,000	90-110	100-180	Forest land 4/ Cropland (pasture, & silage) - limited	Andic Dystrochrepts	Fine-loamy, mixed, mesic	Hoquiam	30	Terraces	Till	Clay loam	Clay loam or silty clay loam	None	--	60"+	Mod
						--	--	Rockland 5/	30	Uplands	Sedimentary & igneous rock	--	--	--	--	0-10" over bedrock	--
						Typic Haplorthods	Loamy-skeletal, mixed, mesic	Copalis	25	Terraces	Till	Gravelly silt loam	Clay loam	Gravel	20-35 in top 18"; 60 below 24-48"	24-48" over gravelly cemented material	Mod
	7	600-4,000	50-100	50-120	Forest land 4/	Duric Haplorthods	Coarse-loamy, mixed, mesic	Shelton	40	Uplands	Glacial till	Gravelly sandy loam	Very gravelly sandy loam	Gravel	20-35 in profile	30-36" over cemented till	Rap
						Typic Haplorthods	Sandy-skeletal, mixed, mesic	Grove	30	Uplands (plains)	Glacial outwash	Gravelly sandy loam	Gravelly loam or gravelly sandy loam	Gravel and sand	20-35 in profile; 60 below 30-60"	30-60"+ over gravel and sand	Mode to r

Table 207 - Continued

Percentage[5/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Range of: Major Capability Subclass: Irrigated[6/]	Major Soil Problems	Suitable Land Treatment and Structures
25	Fans	Alluvium	Loam	Clay loam	None	--	60"+	Moderate	Moderate	Good	Medium and high	IIe, IIIe, IIIs, IVe, VIe	IIe, IIIe IIIs IVe	Erosion	Residue mgmt; cross-slope operations; pastureland mgmt; irrigation management
20	Flood plains	Alluvium	Fine sandy loam	Sandy loam	Gravel	0-15 in profile	60"+	Rapid	Rapid	Somewhat excessive	Medium	IIw IIs	IIw IIs	Sandy profile; flooding	Flood protection; residue mgmt; winter cover; irrigation management
10	Bottom-lands	Alluvium	Silty clay loam	Silty clay	None	--	60"+	Moderately slow	Moderately slow	Good	Medium and high	I IIe	I IIe	Erosion; clayey profile	Residue mgmt; irrigation management
10	Flood plains	Alluvium	Sandy loam	Very cobbly sand	Stones, cobbles & gravel	35-60 below top 10" in profile	10-20" over gravel	Very rapid	Very rapid	Excessive	Low	IVw IVs	IVw IVs	Flooding; shallow over gravel; stony below top 10" in profile	Flood protection; pastureland mgmt; irrigation management
10	Flood plains	Alluvium	Loam	Loam	None	--	60"+	Moderate	Moderate	Good	High	I, IIw	I, IIw	Fertility & organic matter maintenance; flooding	Flood protection; residue mgmt; winter cover; irrigation management
5	Bottom-lands	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderate	Moderately slow	Good	High	I, IIw	I, IIw	Fertility & organic matter maintenance; occasional high water table; occasional flooding	Residue mgmt; irrigation management
30	Terraces	Till	Clay loam	Clay loam or silty clay loam	None	--	60"+	Moderate	Moderate	Good	High	VIe VIs VIIe	--	Erosion; acid soil	Forest land management
30	Uplands	Sedimentary & igneous rock	--	--	--	--	0-10" over bedrock	--	Impervious	Good	Low	VIIIs	--	Shallow over bedrock	--
25	Terraces	Till	Gravelly silt loam	Clay loam	Gravel	20-35 in top 18"; 60 below 24-48"	24-48" over gravelly cemented material	Moderate	Rapid	Good	Low and medium	VIe VIs VIIe	--	Erosion; gravelly profile; acid soil	Forest land management
40	Uplands	Glacial till	Gravelly sandy loam	Very gravelly sandy loam	Gravel	20-35 in profile	30-36" over cemented till	Rapid	Slow	Good	Medium	VIe VIIe	--	Erosion; moderately deep over cemented till; gravelly profile; acid soil	Forest land management
30	Uplands (plains)	Glacial outwash	Gravelly sandy loam	Gravelly loam or gravelly sandy loam	Gravel and sand	20-35 in profile; 60 below 30-60"	30-60"+ over gravel and sand	Moderate to rapid	Very rapid	Good	Low and medium	VIe VIs	--	Erosion; moderately deep over gravel & sand in places; gravelly profile; acid soil	Forest land management

2

Table 207 - Continued

Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeabi[lity] Subso[il]
Moderately deep soils with gravelly, loamy subsoils on nearly level to moderate slopes.	8	0-750	35-40	150-180	Forest land[4]	Typic Xerumbrepts	Sandy-skeletal, mixed, mesic	Spanaway	40	Terraces (outwash plain)	Glacial outwash	*Gravelly loam*	Gravelly sandy loamy	Gravel and cobbles	20-35 in profile; 60 below 20-40"	20-40" over outwash gravel & cobbles	Very rap
					Cropland (berries, cereals, pasture & silage) - 50% irrigated	Duric Haplorthods	Loamy-skeletal, mixed, mesic	Alderwood	30	Terraces	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	20-40" over cemented till	Rapid
						Typic Haplorthods	Loamy-skeletal, mixed, mesic	Everett	10	Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile;60 below 20-36"	20-36" over gravel & sand	Rapid
	9	1,000-2,700	20-60	140-170	Forest land[4]	Duric Haplorthods	Loamy-skeletal, mixed, mesic	Alderwood	35	Uplands (undulating to rolling plains)	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	20-40" over cemented till	Rapid
					Cropland (hay, pasture and silage)-5% irrigated	Typic Haplorthods	Loamy-skeletal, mixed, mesic	Everett	30	Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel & sand	20-35 in profile;60 below 20-36"	20-36" over gravel and sand	Rapid
						Aquic Dystrochrepts	Fine-loamy, mixed, mesic	Cloquallum	10	Terraces (nearly level to hilly)	Lake sediments	Silt loam	Silt loam	None	--	60"+ over clayey lake sediments	Moderate
						Typic Xeropsamments	Mixed, mesic	Indianola	5	Terraces	Glacial material	Loamy sand	Loamy sand or sand	None	--	60"+ over sand	Very rapid
Moderately deep to very deep, acid soils with gravelly loamy and sandy subsoils on gentle to strong slopes.	10	0-3,000	13-35	100-180	Forest land[4]	Dystric Xerochrepts	Fine-loamy, mixed, mesic	Elwha	25	Uplands (plains & footslopes)	Glacial till	Loam	Gravelly sandy loam	Gravel	20-35 below 10" in profile	60"+	Rapid
					Cropland (pasture, silage and hay) - 50% irrigated	Dystric Xerochrepts	Coarse-loamy, mixed, mesic	Clallam	20	Uplands (plains)	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	40"+ over compact cobbly till	Rapid
						Typic Haplorthods	Loamy-skeletal, mixed, mesic	Everett	10	Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile; 60 below 20-36"	20-36" over gravel & sand	Rapid
						Typic *Xeropsamments*	Mixed, mesic	Keystone	10	Terraces	Glacial outwash	Loamy sand	Loamy sand to sand	None	--	20-40" over sand	Very rapid

Table 207 - Continued

...on	Soil Characteristics						Soil Qualities and Interpretations							
				Coarse Fragments						Total Available Water-holding	Range of: Major Capability Subclass 6/			
...cape	Parent Material	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Capacity	Dryland	Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
...ces ...ash ...)	Glacial outwash	Gravelly loam	Gravelly sandy loamy	Gravel and cobbles	20-35 in profile; 60 below 20-40"	20-40" over outwash gravel & cobbles	Very rapid	Very rapid	Excessive	Low	VIs	--	Gravelly & cobbly profile & substrata	Forest land management; pastureland management
...ces	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	20-40" over cemented till	Rapid	Very slow	Good and moderately good	Medium	IVs, VIe VIs VIIe	IVs	Erosion; moderately deep over cemented till;gravelly profile	Forest land mgmt; pastureland mgmt; irrigation mgmt.
...ces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	*20-35 in* profile;60 below 20-36"	*20-36" over* gravel & sand	*Rapid*	*Very rapid*	*Somewhat* excessive	*Low*	*VIs* VIIe	--	*Erosion; moderately* deep over gravel & sand;gravelly profile	*Forest land mgmt; pas-*tureland mgmt.
...ds ...lat- ...o ...ing ...s)	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	20-40" over cemented till	Rapid	Very slow	Good and moderately good	Medium	IVe, VIe VIs VIIe	--	Erosion; moderately deep over cemented till;gravelly profile	Forest land mgmt; pastureland mgmt.
...aces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel *& sand*	20-35 in *profile;60* below 20-36"	20-36" over *gravel and* sand	Rapid	Very rapid	Somewhat excessive	Low	VIs VIIe	--	Erosion; moderately deep over gravel & sand;gravelly profile	Forest land mgmt; pastureland mgmt.
...aces ...rly ...l to ...y)	Lake sediments	Silt loam	Silt loam	None	--	60"+ over clayey lake sediments	Moderate	Slow	Moderately good	High	IIIs IVe VIe	IIIs IVe	Erosion	Forest land management; irrigation management; pastureland management
...aces	Glacial material	Loamy sand	Loamy sand or sand	None	--	60"+ over sand	Very rapid	Very rapid	Good	Low	IVe IVs	--	Erosion; sandy profile	Forest land mgmt; pastureland mgmt.
...nds ...ins & ...slopes)	Glacial till	Loam	Gravelly sandy loam	Gravel	20-35 below 10" in profile	60"+	Rapid	Rapid	Moderately good	Medium	VIs	--	Gravelly profile below 10"; acid soil	Forest land management
...nds ...ins)	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	40"+ over compact cobbly till	Rapid	Very slow	Good	Low	IVs VIs	IVs	Gravelly profile; acid soil	Forest land mgmt; pastureland mgmt; irrigation mgmt; soil amendments
...races	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile; 60 below 20-36"	20-36" over gravel & sand	Rapid	Very rapid	Somewhat excessive	Low	VIs VIIe	--	Erosion;moderately deep over gravel & sand;gravelly profile	Forest land management; pastureland management
...races	Glacial outwash	Loamy sand	Loamy sand to sand	None	--	20-40" over sand	Very rapid	Very rapid	Somewhat excessive	Low	VIe VIs	--	Erosion; sandy profile	Forest land management; pastureland management

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Table 207 - Continued

Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth
	Soil Association					**Classification**					**Soil Characteristics**					
Shallow to moderately deep soils with rocky, loamy subsoils and cold winters on strong to very steep slopes.	11	2,000-6,500	40-80	60-120	Forest land[4]	Haplumbrepts plus Haplorthods, Humaquepts, and Histosols	Fine-loamy and loamy-skeletal, mixed, frigid	--	100	Uplands (plains and footslopes)	Glacial till over sedimentary & basic igneous rock	--	--	--	--	60"+ and 0-10 over bedrock
Deep, acid soils with clayey and loamy subsoils on gentle to steep slopes.	12	700-2,000	70-80	180-260	Forest land[4]	Typic Haplohumults	Clayey mixed, mesic		45	Foothills	Marine sedimentary	Silty clay loam	Silty clay	None	--	40-60"
						Aquic Haplohumults	Clayey, mixed, mesic		20	Swales	Alluvium	Silty clay loam	Silty clay	None	--	40-60"
	13	50-1,600	40-60	50-150	Forest land[4] Cropland (pasture, hay, silage & cereals)-dryland	Dystric Xerochrepts	Coarse-loamy over sandy, or sandy-skeletal, mixed, mesic	Vader	40	Uplands (ridgetops and side slopes)	Sedimentary rock (sandstone)	Loam	Loam	None	--	30-72"+ over bedrock
						Pachic Haplumbrepts	Fine-silty, mixed, mesic	Knappa	30	Terrace (front escarpment)	Alluvium	Silt loam	Silty clay loam	None	--	60"+
						Andic Haplumbrepts	Fine, mixed, mesic	Astoria	20	Mountainous uplands	Sedimentary rock (siltstone or shale)	Silt loam	Silty clay	None	--	40"+ over bedrock
Moderately deep soils with fine-loamy and clayey subsoils on gentle to strong slopes.	14	250-1,600	30-50	140-200	Rangeland Forest land Cropland	Ultic Haploxerolls	Fine-loamy, mixed, mesic	Steiwer	40	Uplands	Sedimentary bedrock (sandstone)	Silt loam	Silty clay loam	Gravel	10-20 in profile	20-40"
						Ultic Haploxeralfs	Fine, mixed, mesic	Sutherlin	15	Upland	Sedimentary bedrock (siltstone)	Silty clay loam	Silty clay	None	--	20-40" over bedrock
						Aqualtic Haploxerolls	Very fine, mixed, mesic	Hazelair	15	Uplands	Alluvium-colluvium, sedimentary bedrock	Silty clay loam or silt loam	Clay	None	--	20-40" over fractured bedrock
						Typic Umbraqualfs	Fine, mixed, mesic	Yoncalla	15	Fans and terraces	Alluvium	Silty clay	Clay	Gravel	10 in profile	40-60"

Table 207 - Continued

Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
Uplands (plains and footslopes)	Glacial till over sedimentary & basic igneous rock	--	--	--	--	60"+ and 0-10 over bedrock	Rapid	--	Moderately good	Low and medium	VIs VIIe	--	Erosion with major cover disturbances	Continued forest land mgmt, limit wet weather logging
Foothills	Marine sedimentary	Silty clay loam	Silty clay	*None*	--	40-60"	Moderately slow	Slow	Good	Medium	IVe VIe	--	Erosion	Forest land management; *rangeland management*
Swales	Alluvium	Silty clay loam	Silty clay	None	--	40-60"	Moderate	Slow	Somewhat poor	Medium	IVw VIw	--	Wetness	Forest land mgmt; pasture land mgmt; drainage
Uplands (ridgetops and side slopes)	Sedimentary rock (sandstone)	Loam	Loam	None	--	30-72"+ over bedrock	Moderately rapid	Impervious	Somewhat excessive	Low to *high*	VIe *VIIe*	--	Erosion; moderately *deep over* bedrock in places; acid soil	Forest land management
Terrace (front escarpment)	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderate	Moderate	Good	High	IIIs VIe VIIe	--	Erosion; acid soil	Forest land management; soil amendments; restrict logging during prolonged wet periods
Mountainous uplands	Sedimentary rock (siltstone or shale)	Silt loam	Silty clay	None	--	40"+ over bedrock	Moderate	Slow to impervious	Good	Medium and high	IVe VIe VIIe	--	Erosion; moderately deep over bedrock in places; acid soil	Forest land management; restrict logging during prolonged wet periods
Uplands	Sedimentary bedrock (sandstone)	Silt loam	Silty clay loam	Gravel	10-20 in profile	20-40"	Moderate	Very slow to impervious	Good	Low to medium	IIIe IVe VIe	--	Erosion; droughtiness	Rangeland management; pastureland management
Upland	Sedimentary bedrock (siltstone)	Silty clay loam	Silty clay	None	--	20-40" over bedrock	Moderately slow	Slow to impervious	Moderately good	Medium and high	IIIe IVe VIe VIIe	--	Erosion; moderately deep and deep over bedrock	Cross-slope opers;pastureland mgmt;cropping seq; forest land mgmt;residue mgmt;restrict logging opers during prolonged wet period
Uplands	Alluvium-colluvium, sedimentary bedrock	Silty clay loam or silt loam	*Clay*	*None*	--	*20-40" over* fractured bedrock	*Slow*	*Slow to* impervious	*Moderately* good & somewhat poor	Medium and low	IIIe IVe	--	Erosion; wetness; moderately deep over bedrock; clay subsoil	Cross-slope opers;residue mgmt; cropping sequence; subsurface tillage; pastureland management
Fans and terraces	Alluvium	Silty clay	Clay	Gravel	10 in profile	40-60"	Slow	Very slow to impervious	Somewhat poor	Medium to low	IVw	--	Wetness; erosion	Pastureland mgmt; drainage

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Table 207 - Continued

Soil Association: Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Per
Very deep, acid soils with sandy profiles on gentle to strong slopes.	17	0-75	70-90	180-230	Forest land[4/] Cropland (hay and pasture)-dryland	Entic Haplorthods	Sandy, mixed, mesic	Netarts	20	Terraces (duned)	Beach sand	Loamy sand	Sand	None	--	60"+	Ver
						Typic Udipsamments	Mixed, mesic	Westport	15	Terraces (duned)	Sand	Sandy loam	Fine sand	None	--	60"+	Ver
						Aquic Haplorthods	Sandy, mixed, mesic	Yaquina	15	Basins	Sand	Loamy fine sand and fine sand	Fine sand	None	--	24-48" over water table	Ver
						--	--	Duneland[5/]	15	Terraces (duned)	Sand	Fine sand	Fine sand	None	--	60"+	Ver
						--	--	Mukilteo	10	Basins	Peat and muck	Muck	Peat	None	--	60"+	Rap
						Typic Sideraquods	Fine-loamy, mixed, mesic, ortstein	Depoe	5	Basins	Alluvium	Clay loam	Clay loam	None	--	12-24" over ortstein	Slo
Moderately deep to very deep soils with loamy subsoils on gentle to very steep slopes.	18	200-1,800	45-75	180-200	Forest land[4/]	Aquic Fraquimbrepts	Fine, silty, mixed, mesic	Cascade	45	Uplands (ridgetops & gentle to steep slopes)	Loess and old alluvium	Silt loam	Silty clay loam	None	--	20-30" over fragipan	Slo
						Andic Fraquimbrepts	Fine, silty, mixed, mesic	Goble	35	Uplands (ridgetops and side slopes)	Loess	Silt loam	Silty clay loam	None	--	30-40" over fragipan	Mod slo
						Humic Fragiaquepts	Fine-silty, mixed, mesic	Delena	2	Uplands (swales)	Loess	Silt loam	Silty clay loam	None	--	20-30" over fragipan	Slo
						Ultic Haploxeralfs	Fine, silty, mixed, mesic	Laurelwood	1	Uplands (ridgetops and side slopes)	Loess	Silt loam	Silty clay loam	None	--	60"+	Mod

Table 207 - Continued

Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of Major Capability Subclass 6/: Dryland	Range of Major Capability Subclass 6/: Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
	Soil Characteristics						Soil Qualities and Interpretations							
Terraces (duned)	Beach sand	Loamy sand	Sand	None	--	60"+	Very rapid	Very rapid	Excessive	Low	VIe VIIe	--	Droughtiness; coarse texture	Forest land management
Terraces (duned)	Sand	Sandy loam	Fine sand	None	--	60"+	Very rapid	Very rapid	Excessive	Low	IVe VIIe	--	Erosion; sandy profile; acid soil	Forest land mgmt; soil amendments; pastureland management
Basins	Sand	Loamy fine sand and fine sand	Fine sand	None	--	24-48" over water table	Very rapid	Very rapid	Somewhat poor	Low	IIIw	--	Seasonal high water table; sandy profile; acid soil	Drainage; soil amendments; pastureland management
Terraces (duned)	Sand	Fine sand	Fine sand	None	--	60"+	Very rapid	Very rapid	Excessive	Low	VIIIe	--	Erosion; sandy profile	Duneland stabilization
Basins	Peat and muck	Muck	Peat	None	--	60"+	Rapid	Slow	Very poor	Low	VIIs	--	Wetness; overflow; subsidence; watertable	Drainage; pumping; dikes; soil amendments; water table control
Basins	Alluvium	Clay loam	Clay loam	None	--	12-24" over ortstein	Slow	Impervious in ortstein	Poor	Low	IVw	--	Perched water table; shallow over ortstein; acid soil	Pastureland mgmt; soil amendments
Uplands (ridgetops & gentle to steep slopes)	Loess and old alluvium	Silt loam	Silty clay loam	None	--	20-30" over fragipan	Slow	Very slow to impervious	Somewhat poor	High	IIIe IVe VIe VIIe	--	Erosion; wetness	Forest land management
Uplands (ridgetops and side slopes)	Loess	Silt loam	Silty clay loam	None	--	30-40" over fragipan	Moderately slow	Slow	Good and moderately good	High	IIIe IVe VIe VIIe	--	Erosion	Forest land management
Uplands (swales)	Loess	Silt loam	Silty clay loam	None	--	20-30" over fragipan	Slow	Very slow	Poor	High	IIIw	--	Wetness	Drainage; forest land management
Uplands (ridgetops and side slopes)	Loess	Silt loam	Silty clay loam	None	--	60"+	Moderate	Moderate	Good	High	IIe, IIIe IVe VIe VIIe	--	Erosion	Forest land management

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Table 207 - Continued

Soil Association						Classification			Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics			Coarse Fragments		
Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series[2/]			Parent Material	Texture Surface Soil	Texture Subsoil	Kind	Percent	Prof
Deep and very deep soils with loamy and gravelly subsoils on gentle to steep slopes.	19	1,000-1,200	40-60	130-170	Forest land Cropland (pasture & hay) - 50% irrigated	Typic Xerochrepts	Fine-loamy, mixed, mesic	Kerby	35	Flood plains	Alluvium	Loam	Clay loam	Gravel	60 below 40-50"	40-5 grav
						Ultic Haploxeralfs	Fine-loamy, mixed, mesic	Abegg	20	Terraces	Alluvium	Loam	Clay loam	None	--	60"+ root betw
						Pachic Argixerolls	Fine-silty, mixed, mesic	Medford	10	Terraces	Alluvium	Silt loam	Silty clay loam	None	--	60"+
						Fluventic Haploxerolls	Coarse-loamy, mixed, mesic	Newberg	10	Flood plains	Alluvium	Fine-sandy loam	Sandy loam	Gravel	0-15 in profile	60"+
						Pachic Haploxerolls	Coarse-loamy, mixed, mesic	Central Point	10	Terraces	Alluvium	Sandy loam	Sandy loam	None	--	60"+
	20	0-2,500	70-120	50-150	Forest land[4/] Cropland (pasture, silage and cereals) limited	Pachic Xerumbrepts	Coarse-silty, mixed, mesic	Germany	40	Uplands	Loess and basic igneous rock	Silt loam	Silt loam	None	--	60"+
						Xeric Haplohumults	Clayey, mixed, mesic	Olympic	35	Uplands & mountain slopes	Basic igneous rock	Clay loam	Clay loam or silty clay loam	None	--	40-72 over bedro
						Ultic Haploxeralfs	Fine-silty, mixed, mesic	Olequa	10	Terraces	Alluvium	Silt loam	Silt loam or silty clay loam	None	--	60"+

Table 207 - Continued

ition on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
Flood plains	Alluvium	Loam	Clay loam	Gravel	60 below 40-50"	40-50" over gravel	Moderate	Very rapid	Good	Medium	IIe IIs IVs	IIe IIs IVs	Erosion	Pastureland mgmt; forest land mgmt; irrigation management
Terraces	Alluvium	Loam	Clay loam	None	--	60"+ (slight root restriction between 25-40")	Moderate	Moderate	Good	High	IIIe IVs	IIIe IVs	Erosion	Pastureland mgmt; forest land mgmt; irrigation management
Terraces	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderate	Moderate	Good	High	IIe IIIe	IIe IIIe	Erosion	Residue mgmt; cross-slope opers;irrigation mgmt.
Flood plains	Alluvium	Fine-sandy loam	Sandy loam	Gravel	0-15 in profile	60"+	Rapid	Rapid	Somewhat excessive	Medium	IIw	IIw	Flooding	Flood protection;residue mgmt; winter cover;irrigation management
Terraces	Alluvium	Sandy loam	Sandy loam	None	--	60"+	Moderately rapid	Rapid	Good	Medium	I	I	Erosion	Residue mgmt; irrigation management
Uplands	Loess and basic igneous rock	Silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	IIe,IIIe IVe VIe	--	Erosion; acid soil	Forest land mgmt; soil amendments;residue mgmt; cropping sequence
Uplands & mountain slopes	Basic igneous rock	Clay loam	Clay loam or silty clay loam	None	--	40-72"+ over bedrock	Moderate	Impervious	Good	Medium and high	IIe,IIIe IVe VIe	--	Erosion; acid soil	Forest land mgmt; soil amendments;residue mgmt; cropping sequence
Terraces	Alluvium	Silt loam	Silt loam or silty clay loam	None	--	60"+	Moderate & moderately slow	Moderate & moderately slow	Good & moderately good	High	IIs,IIIe IVe VIe VIIe	--	Erosion; acid soil	Forest land management

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Table 207 - Continued

Soil Groups	Soil Association: Map Sym.	Soil Association: Elevation Feet	Soil Association: Precip. Inches	Soil Association: Freeze free Season Days	Soil Association: Major land use	Classification: Great Group or Subgroup	Classification: Family	Classification: Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Soil Characteristics: Texture Surface Soil	Soil Characteristics: Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	
	15	1,000-2,500	40-60	130-180	Forest land[4/] Rangeland	Ultic Haploxeralfs	Fine-loamy, mixed, mesic	Willakenzie	40	Uplands	Sedimentary bedrock (siltstone)	Silty clay loam	Silty clay loam	None	--	20-40" over bedrock	M s
						Mollic Ultic Haploxeralfs	Fine-loamy, mixed, mesic		30	Uplands	Sedimentary bedrock (sandstone)	Loam	Loam to fine sandy loam	--	--	20-40"	M m r
						Typic Umbraqualfs	Fine, mixed, mesic	Yoncalla	15	Fans and terraces	Alluvium	Silty clay	Clay	Gravel	10 in profile	40-60"	S
Moderately deep to very deep soils with loamy and gravelly subsoils on gentle to very steep slopes.	16	1,000-2,500	30-50	100-150	Forest land[4/] Cropland (pasture and hay) - 30% irrigated	Ultic Haploxerults	Fine-loamy, mixed, mesic	Josephine	50	Uplands	Sedimentary bedrock	Loam	Clay loam	None	--	20-40" over fractured bedrock	M
						Ultic Haploxeralfs	Fine-loamy, mixed, mesic	Ruch	15	Fans	Alluvium	Loam	Clay loam	None	--	60"+	M
						Ultic Haploxeralfs	Fine-loamy, mixed, mesic	Boomer	15	Uplands	Metamorphic bedrock	Gravelly clay loam	Gravelly clay loam	Gravel and cobbles	20-35 in profile	20-40" over bedrock	Mc
						Typic Rhodoxeralfs	Fine, mixed, mesic	Pollard	10	Uplands (rolling footslopes)	Acidic rock	Clay loam	Clay	None	--	60"+	Mo sl
						Typic Xerochrepts	Fine-loamy, mixed, mesic	Kerby	5	Flood plains	Alluvium	Loam	Clay loam	Gravel	60 below 40-50"	40-50" over gravel	Mo

Table 207 - Continued

Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of Major Capability Subclass: Dryland	Range of Major Capability Subclass: Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
Uplands	Sedimentary bedrock (siltstone)	Silty clay loam	Silty clay loam	None	--	20-40" over bedrock	Moderately slow	Slow to impervious	Good	Medium and high	IIe, IIIe IVe VIs VIIe	--	Erosion; moderately deep and deep over bedrock	Cross-slope opers; pastureland mgmt; crop.seq; residue mgmt; forest land mgmt; restrict logging during prolonged wet per.
Uplands	Sedimentary bedrock (sandstone)	Loam	Loam to fine sandy loam	--	--	20-40"	Moderate to moderately rapid	Moderate to impervious	Good	Low to medium	IIIe IVe VIe	--	Erosion	Forest land mgmt; rangeland management
Fans and terraces	Alluvium	Silty clay	Clay	Gravel	10 in profile	40-60"	Slow	Very slow to impervious	Somewhat poor	Medium to low	IVw	--	Wetness; erosion	Pastureland mgmt; drainage
Uplands	Sedimentary bedrock	Loam	Clay loam	None	--	20-40" over fractured bedrock	Moderate	Slow	Good	Medium	VIe VIIe	--	Erosion; moderately deep over bedrock	Forest land mgmt; restrict logging during prolonged wet periods
Fans	Alluvium	Loam	Clay loam	None	--	60"+	Moderate	Moderate	Good	Medium and high	IIIw IVe VIe	IIIs IVe	Erosion	Residue mgmt; cross-slope opers; forest land mgmt; pastureland mgmt; irrigation management
Uplands	Metamorphic bedrock	Gravelly clay loam	Gravelly clay loam	Gravel and cobbles	20-35 in profile	20-40" over bedrock	Moderate	Impervious	Good	Medium to low	VIe VIIe	--	Erosion	Forest land mgmt.
Uplands (rolling footslopes)	Acidic rock	Clay loam	Clay	None	--	60"+	Moderately slow	Impervious	Good	High	IIIe IVe	IIIe IVe	Erosion; clayey profile	Forest land mgmt; pastureland mgmt; irrigation management
Flood plains	Alluvium	Loam	Clay loam	Gravel	60 below 40-50"	40-50" over gravel	Moderate	Very rapid	Good	Medium	IIe, IIs IVs	IIe, IIs IVs	Erosion	Pastureland mgmt; forest land mgmt; irrigation mgmt

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Table 207 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth
Moderately deep to very deep soils with fine-loamy and clayey subsoils on gentle to steep slopes.	21	300-1,200	40-60	190-200	Forest land Cropland	Xeric Haplohumults	Clayey, mixed, mesic	Nekia	30	Uplands	Basic igneous rock	Silty clay loam	Clay	Gravel, cobbles & stones	0-20 in profile	20-40" over bedrock
						Xeric Haplohumults	Clayey, mixed, mesic	Jory	25	Uplands	Colluvium from basic igneous rock	Silty clay loam	Clay	Gravel, cobbles & stones	0-20 in profile	40-60"+ over bedrock
						Typic Umbraqualfs	Fine, mixed, mesic	Yoncalla	15	Fans and terraces	Alluvium	Silty clay	Clay	Gravel	10 in profile	40-60"
						Entic Pelloxererts	Very fine, montmorillonitic, mesic	Drain	10	Bottomland	Alluvium	Clay	Clay	None	--	60"+
	22	800-3,500	55-90	120-190	Forest land[4]	Typic Haplumbrepts	Fine, mixed, mesic	McCully	50	Uplands (moderately steep)	Basic igneous rock	Clay loam	Clay	Cobbles and gravel	0-15 in profile	60"+
						Andic Haplumbrepts	Fine-loamy, mixed, mesic	Kinney	30	Uplands (moderately to steeply sloping)	Basic igneous rock	Cobbly loam	Cobbly clay loam	Cobbles and gravel	20-35 in profile	36-60" over breccia bedrock
Shallow soils to cemented hardpan or bedrock with loamy subsoils on nearly level to moderate slopes.	23	1,200-1,400	17-20	160-170	Rangeland	Typic Durochrepts	Fine-loamy, mixed, mesic	Agate	30	Terraces	Alluvium	Loam	Clay loam	None	--	10-24" over hardpan
					Cropland (pasture-irrigated)	--	--	Rockland[5]	20	Terraces	Alluvium	--	--	--	--	0-10" over cemented gravel, and cobbles
						Typic Xerochrepts	Fine-loamy, mixed, mesic	Debenger	15	Terraces	Sedimentary rock (sandstone)	Loam	Clay loam	None	--	20-30" over bedrock
						Typic Duraquolls	Clayey-skeletal, mixed, mesic		15	Bottomlands	Alluvium	Gravelly clay loam	Gravelly clay	Gravel	20-35 in profile	15-30" over hardpan
						Typic Xerochrepts	Loamy, mixed, mesic, shallow		5	Uplands (rolling hill tops)	Sedimentary rock (sandstone)	Loam	Loam	None	--	10-20" over bedrock

Table 207 - Continued

	Soil Characteristics									Soil Qualities and Interpretations				
				Coarse Fragments						Total Available Water-holding	Range of: Major Capability Subclass			
...e	Parent Material	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Capacity	Dryland	Irrigated[6]	Major Soil Problems	Suitable Land Treatment and Structures
	Basic igneous rock	Silty clay loam	Clay	Gravel, cobbles & stones	0-20 in profile	20-40" over bedrock	Moderate	Impervious	Good	Medium and high	IIe IIIe IVe VIe	--	Erosion on moderate and strong slopes	Cross-slope opers;residue mgmt; cropping sequence; irrig. mgmt; forest land mgmt; pastureland mgmt.
	Colluvium from basic igneous rock	Silty clay loam	Clay	Gravel, cobbles & stones	0-20 in profile	40-60"+ over bedrock	Moderate	Moderately slow	Good	High	IIe IIIe IVe VIe	--	Erosion on strong slopes	Cross-slope opers;residue mgmt;cropping sequence; irrig. mgmt; forest land management
...d ...s	Alluvium	Silty clay	Clay	Gravel	10 in profile	40-60"	Slow	Very slow to impervious	Somewhat poor	Medium to low	IVw	--	Wetness; erosion	Pastureland management; drainage
...and	Alluvium	Clay	Clay	None	--	60"+	Very slow	Very slow	Poor	Low	IVw VIw	--	Erosion; droughtiness	Pastureland mgmt; drainage;irrigation mgmt; residue management
...tely	Basic igneous rock	Clay loam	Clay	Cobbles and gravel	0-15 in profile	60"+	Moderate	Moderately slow	Good	High	IIe,IIIe IVe VIe VIIe	--	Erosion; clayey profile; acid soil	Forest land mgmt;cross-slope opers;residue mgmt; cropping sequence; soil amendments;pastureland management
...tely ...ply ...)	Basic igneous rock	Cobbly loam	Cobbly clay loam	Cobbles and gravel	20-35 in profile	36-60" over breccia bedrock	Moderate	Impervious	Good	Low and medium	VIs VIIs	--	Erosion; cobbly profile; acid soil	Forest land management
...s	Alluvium	Loam	Clay loam	None	--	10-24" over hardpan	Moderate	Impervious in hardpan	Good	Low	IIIe IVe	IIIe IVe	Erosion; shallow over hardpan	Rangeland mgmt;pastureland mgmt;irrig. mgmt.
...s	Alluvium	--	--	--	--	0-10" over cemented gravel, and cobbles	--	Impervious	Good	Low	VIIIs	--	Shallow over cemented gravel and cobbles	--
...s	Sedimentary rock (sandstone)	Loam	Clay loam	None	--	20-30" over bedrock	Moderate	Impervious	Good	Low	IIIe	IIIe	Erosion;moderately deep over bedrock	Pastureland management; irrigation management
	Alluvium	Gravelly clay loam	Gravelly clay	Gravel	20-35 in profile	15-30" over hardpan	Moderately slow	Impervious in hardpan	Poor	Low	IVw	IVw	Wetness;moderately deep over hardpan; gravelly profile	Drainage;pastureland mgmt; irrigation mgmt.
...g ...ps)	Sedimentary rock (sandstone)	Loam	Loam	None	--	10-20" over bedrock	Moderate	Impervious	Good	Low	IVe VIe	IVe	Erosion; shallow over bedrock	Rangeland mgmt;pasture-land mgmt; irrigation management

2

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Dept
Moderately deep to very deep soils with very fine clayey profiles on gentle to strong slopes.	24	1,500-3,500	17-25	100-160	Forest land Rangeland Cropland (pasture)-dryland	Typic Chromoxererts	Very fine, montmorillonitic, mesic	Climax	25	Fans	Basic igneous bedrock	Silty clay	Clay	Gravel, cobbles	15 in profile	40-60
						Ultic Argixerolls	Fine, mixed, frigid		20	Uplands	Basic rock	Loam	Clay	None	--	20-30" over bedrock
						Typic Chromoxererts	Fine, montmorillonitic, mesic	Carney	15	Uplands (rolling hills)	Tuff	Clay	Clay	None	--	20-40" over bedrock
						Pachic Ultic Argixerolls	Fine, mixed, mesic	Dixonville	15	Uplands	Basic igneous rock	Silty clay loam	Silty clay	Gravel, cobbles	0-20 in profile	15-30"
						Typic Xerochrepts	Loamy, mixed, mesic, shallow		10	Uplands (rolling hills)	Sedimentary rock (sandstone)	Loam	Loam	None	--	10-20" over bedrock
						Entic Pelloxererts	Very fine, montmorillonitic, mesic	Phoenix	5	Fans and basins	Tuff	Clay	Clay	None	--	20-40" over bedrock
	25	1,200-1,500	17-20	160-180	Cropland (pasture and hay)-80% irrigated	Typic Chromoxererts	Fine, montmorillonitic, mesic	Carney	25	Fans	Tuff	Clay	Clay	None	--	20-40" over bedrock
					Rangeland	Chromic Pelloxererts	Fine, montmorillonitic, mesic	Coker	20	Basins and bottomlands	Tuff	Clay	Clay	None	--	60"+
						Entic Pelloxererts	Very fine, montmorillonitic, mesic	Phoenix	20	Fans and basins	Tuff	Clay	Clay	None	--	20-40" over bedrock
						Typic Xerochrept	Loamy-mixed, mesic, shallow		20	Uplands (rolling hills)	Sedimentary rock (sandstone)	Loam	Loam	None	--	10-20" over bedrock

Table 207 - Continued

on	Soil Characteristics						Soil Qualities and Interpretations							
				Coarse Fragments						Total Available Water-holding Capacity	Range of: Major Capability Subclass			
ape	Parent Material	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class		Dryland	Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
	Basic igneous bedrock	Silty clay	Clay	Gravel, cobbles	15 in profile	40-60	Slow	Very slow and impervious	Good	Low to medium	IVs VIs	IIIs	Droughtiness	Rangeland mgmt;irrigation mgmt; residue mgmt;cross-slope opers;cropping seq.
s	Basic rock	Loam	Clay	None	--	20-30" over bedrock	Moderately slow	Impervious	Good	Low	VIe	--	Erosion;moderately deep over bedrock	Forest land management
s ng	Tuff	Clay	Clay	None	--	20-40" over bedrock	Moderately slow	Impervious	Good	Low and medium	IVe IVs VIe	--	Erosion;moderately deep over bedrock	Rangeland management; pastureland management
s	Basic igneous rock	Silty clay loam	Silty clay	Gravel, cobbles	0-20 in profile	15-30"	Moderately slow	Impervious	Good	Low	IVs VIe	--	Erosion; droughtiness	Rangeland management; pastureland management
s ng	Sedimentary rock (sandstone)	Loam	Loam	None	--	10-20" over bedrock	Moderate	Impervious	Good	Low	IVe VIe	--	Erosion; shallow over bedrock	Rangeland management
nd	Tuff	Clay	Clay	None	--	20-40" over bedrock	Very slow	Impervious	Poor	Low	IVe IVs	IVe IVs	Erosion;moderately deep over bedrock; clayey profile	Pastureland mgmt; irrigation management
	Tuff	Clay	Clay	None	--	20-40" over bedrock	Moderately slow	Impervious	Good	Low and medium	IVe IVs VIe	IVe IVs	Erosion;moderately deep over bedrock; clayey profile	Pastureland mgmt;range-land mgmt; irrigation management
and lands	Tuff	Clay	Clay	None	--	60"+	Very slow	Impervious	Poor	Low	IVs	IVs	Clayey profile	Pastureland mgmt; irrigation management
nd	Tuff	Clay	Clay	None	--	20-40" over bedrock	Very slow	Impervious	Poor	Low	IVe IVs	IVe IVs	Erosion;moderately deep over bedrock; clayey profile	Pastureland mgmt; irrigation management
s ng	Sedimentary rock (sandstone)	Loam	Loam	None	--	10-20" over bedrock	Moderate	Impervious	Good	Low	IVe VIe	--	Erosion; shallow over bedrock	Rangeland mgmt; pastureland mgmt.

2

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Dept
Moderately deep soils with loamy, gravelly and cobbly subsoils on moderate to extremely steep slopes.	26	500-4,000	60-90	170-200	Forest land[4]	Typic Haplumbrepts	Loamy-skeletal, mixed, mesic	Klickitat	30	Uplands (steep slopes)	Basic igneous rock	Loam	Cobbly clay loam	Cobbles	20-35 below 10" in profile	20-40" over bedrock
						Typic Haplumbrepts	Fine-loamy, mixed, mesic	Hembre	25	Uplands (ridgetops and steep slopes)	Basic igneous rock	Gravelly loam and silt loam	Gravelly loam and silty clay loam	Gravel, cobbles & stones	20-35 in profile	36-60" over bedrock
						Typic Haplohumults	Clayey, mixed, mesic	Honeygrove	10	Uplands	Sedimentary rock (sandstone)	Silty clay loam	Silty clay	None	--	40-60" over bedrock
						Andic Dystrochrepts	Fine-loamy, mixed, mesic	Marty	10	Uplands	Acid igneous bedrock	Loam	Clay loam	None	--	60"+
						Dystric Eutrochrepts	Loamy-skeletal, mixed, mesic	Hatchery	5	Uplands	Basic igneous rock	Very gravelly loam	Gravelly loam	Gravel	35+ to 9" and 20-35 below 9"	20-32" over bedrock
						Lithic Haplumbrepts	Loamy-skeletal, mixed, mesic	Kilchis	5	Uplands (steep slopes)	Basic igneous rock	Stony loam	Very gravelly silt loam	Stones, cobbles & gravel	20-60 in profile	12-20" over bedrock
Deep and very deep soils with rocky, loamy and clayey subsoils on gentle to very steep slopes.	27	3,500-5,000	30-60	80-110	Forest land[4] Cropland (limited pasture) - irrigated	Haploxerults plus Haploxerolls, Xerocrepts and Xerumbrepts	Fine-loamy, and loamy-skeletal, mixed, frigid	--	100	Uplands (rolling to steep slopes)	Basic rock	--	--	--	--	40-60" over bedrock
	28	1,000-4,000	40-60	100-120	Forest land[4]	Haploxerults plus Haploxerolls, Xerocrepts & Xerumbrepts	Clayey, kaolinitic, and fine-loamy, mixed, mesic and frigid	--	100	Uplands (rolling slopes)	Colluvium, residuum from basic rock	--	--	--	--	40-60"

Table 207 - Continued

...ition on ...dscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass Dryland	Range of: Major Capability Subclass Irrigated[6]	Major Soil Problems	Suitable Land Treatment and Structures
...ands ...eep ...pes)	Basic igneous rock	Loam	Cobbly clay loam	Cobbles	20-35 below 10" in profile	20-40" over bedrock	Moderate	Impervious	Good	Low	VIIe	--	Erosion;moderately deep over bedrock; cobbly subsoil	Forest land management
...ands ...dgetops ...l steep ...pes)	Basic igneous rock	Gravelly loam and silt loam	Gravelly loam and silty clay loam	Gravel, cobbles & stones	20-35 in profile	36-60" over bedrock	Moderate	Impervious	Good	Low and medium	IIIe IVe VIe VIIe	--	Erosion; acid soil	Forest land management; pastureland management
...lands	Sedimentary rock (sandstone)	Silty clay loam	Silty clay	None	--	40-60" over bedrock	Moderately slow	Impervious	Good	Medium and high	IVe VIe	--	Erosion; acid soil	Forest land management
...lands	Acid igneous bedrock	Loam	Clay loam	None	--	60"+	Moderately slow	Very slow	Good	Medium	VIe	--	Erosion	Forest land management
...lands	Basic igneous rock	Very gravelly loam	Gravelly loam	Gravel	35+ to 9" and 20-35 below 9"	20-32" over bedrock	Somewhat rapid	Impervious	Good	Low	VIIe	--	Erosion	Forest land management
...lands ...teep ...opes)	Basic igneous rock	Stony loam	Very gravelly silt loam	Stones, cobbles & gravel	20-60 in profile	12-20" over bedrock	Moderate	Impervious	Good	Low	VIIe VIIs	--	Shallow over bedrock; stony and gravelly profile; acid soil	Forest land management
...lands ...olling ... steep ...opes)	Basic rock	--	--	--	--	40-60" over bedrock	Moderate	--	Good	Low	VIe	--	Erosion with improper land use	Continued forest land management
...plands ...rolling ...lopes)	Colluvium, residuum from basic rock	--	--	--	--	40-60"	Moderate	--	Good	Medium	VIe	--	Erosion with improper land use	Continued forest land management

2

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth
Moderately deep and deep, very cold soils with gravelly, loamy subsoils on moderate to extremely steep slopes.	29	1,000-4,000	40-60	100-120	Forest land[4]	Cryumbrepts plus Cryorthods, Haplorothods Rockland	Fine-loamy, and loamy-skeletal, mixed	--	100	Uplands (sharply broken relief)	Colluvium, residuum from acidic rock	--	--	--	--	20-60" over basalt
Moderately deep to very deep ashy soils with gravelly, loamy and clayey subsoils on moderate to very steep slopes.	30	50-2,000	60-90	100-150	Forest land[4]	Typic Dystrandepts	Ashy, mesic	Bear Prairie	40	Terraces	Volcanic ash over basic igneous rock	Silt loam	Silt loam	None	--	60"+
						Dystric Xerochrepts	Coarse-loamy, mixed, mesic	Loper	20	Mountain slopes and ridges	Basic igneous rock	Cobbly silt loam	Gravelly loam	Gravel and cobbles	20-35 in profile	40"+ over bedrock
						--	--	Rockland[5]	20	Uplands	Basic igneous and sedimentary rock	--	--	--	--	0-10" over bedrock
	31	1,000-2,700	45-80	50-150	Forest land[4]	Andic Glossoboric Hapludalfs	Fine, mixed, mesic	Wilkeson	35	Uplands (footslopes and side slopes)	Volcanic ash and basic igneous rock	Silty clay loam	Clay loam to clay	None	--	36-60"+ over bedrock
						Xeric Haplohumults	Clayey, kaolinitic, mesic	Melbourne	30	Uplands (rolling to hilly)	Sedimentary rock (shale & sandstone)	Silty clay loam	Silty clay	None	--	40-60"+ over bedrock
						Typic Haplohumults	Clayey, mixed, mesic	Garrard	15	Uplands (mountain slopes)	Sedimentary rock (siltstone)	Clay loam	Silty clay	None	--	40-60"+ over bedrock

Table 207 - Continued

Position on Landscape	Soil Characteristics								Soil Qualities and Interpretations					
				Coarse Fragments							Range of: Major Capability Subclass 6/			
	Parent Material	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Dryland	Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
Uplands (sharply broken relief)	Colluvium, residuum from acidic rock	--	--	--	--	20-60" over basalt	Moderate	--	Good	Medium to low	VIe	--	Erosion with improper land use	Continued forest land management
Terraces	Volcanic ash over basic igneous rock	Silt loam	Silt loam	None	--	60"+	Moderate	Impervious	Good	High	IIIs IVe	--	Erosion; acid soil	Forest land management
Mountain slopes and ridges	Basic igneous rock	Cobbly silt loam	Gravelly loam	Gravel and cobbles	20-35 in profile	40"+ over bedrock	Moderate	Impervious	Good	Low and medium	VIe VIIe	--	Erosion; cobbly & gravelly profile; acid soil	Forest land management
Uplands	Basic igneous and sedimentary rock	--	--	--	--	0-10" over bedrock	--	Impervious	Good	Low	VIIIs	--	Shallow over bedrock	--
Uplands (footslopes and side slopes)	Volcanic ash and basic igneous rock	Silty clay loam	Clay loam to clay	None	--	36-60"+ over bedrock	Very slow	Impervious	Good	Medium and high	VIe VIIe	--	Erosion; clayey subsoil; acid soil	Forest land management
Uplands (rolling to hilly)	Sedimentary rock (shale & sandstone)	Silty clay loam	Silty clay	None	--	40-60"+ over bedrock	Moderately slow	Very slow to impervious	Good	Medium and high	IVe VIe VIIe	--	Erosion; clayey subsoil; acid soil	Forest land management; restrict logging during prolonged wet periods
Uplands (mountain slopes)	Sedimentary rock (siltstone)	Clay loam	Silty clay	None	--	40-60"+ over bedrock	Moderately slow	Impervious	Good	Medium and high	VIe VIIe	--	Erosion; clayey subsoil; acid soil	Forest land management; restrict logging during prolonged wet periods

Table 207 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage of Assn. 3/	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Dept
Very deep ashy soils with loamy and sandy subsoils on gentle to very steep slopes.	32	2,500-4,000	50-70	80-120	Forest land 4/ Rangeland Cropland (pasture and hay)-irrigated	Entic Cryandepts	Ashy	Steiger	40	Terraces	Volcanic ash	Fine sandy loam	Fine sand	None	--	60"+
						Typic Vitrandepts	Ashy, mesic	Crater Lake	20	Terraces	Volcanic ash	Fine sandy loam	Fine sandy loam	None	--	60"+
						Ultic Argixerolls	Fine-loamy, mixed, frigid		20	Uplands	Basic rock	Loam	Clay loam	None	--	40-60"+ over bedrock
	33	500-5,000	40-100	50-120	Forest land 4/	Typic Dystrandepts	Ashy, mesic	Cinebar	40	Uplands (mountaineous)	Volcanic ash & basic igneous rock	Silt loam	Silt loam	None	--	60"+ over volcanic ash or bedrock
						Xeric Haplohumults	Clayey, mixed, mesic	Olympic	20	Uplands (mountain slopes)	Basic igneous rock	Clay loam	Clay loam to silty clay loam	None	--	40-72" over bedrock
						Typic Haplorthods	Loamy-skeletal, mixed, mesic	Everett	20	Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile; 60 below 20-36"	20-36" over gravel and sand
Moderately deep to very deep, ashy, very cold soils with sandy subsoils on gentle to very steep slopes.	34	3,500-4,500	15-40	40-100	Forest land 4/ Rangeland	Cryumbrepts plus Cryorthods, Haplorthods and Rockland	Ashy and cinders over loamy, mixed	--	100	Uplands (faulted and dissected plateaus)	Pumice and basic igneous rock	--	--	--	--	20-70" over bedrock

Table 207 - Continued

ition	Soil Characteristics						Soil Qualities and Interpretations							
				Coarse Fragments						Total Available Water-holding Capacity	Range of: Major Capability Subclass 6/			
dscape	Parent Material	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class		Dryland	Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
races	Volcanic ash	Fine sandy loam	Fine sand	None	--	60"+	Very rapid	Very rapid	Excessive	Low	IVc	IVc	Erosion; sandy profile; acid soil	Forest land mgmt;pastureland mgmt; residue mgmt; cross-slope operations; irrigation management
rraces	Volcanic ash	Fine sandy loam	Fine sandy loam	None	--	60"+	Moderately rapid	Moderately rapid	Somewhat excessive	Medium	IVc VIe VIIe	IVc	Erosion; ashy profile; acid soil	Forest land mgmt;pastureland mgmt; residue mgmt; cross-slope operations; irrigation management
lands	Basic rock	Loam	Clay loam	None	--	40-60"+ over bedrock	Moderate	Impervious	Good	Medium and high	IVe VIe	IVe	Erosion	Forest land mgmt; pastureland mgmt.
lands ountain-us)	Volcanic ash & basic igneous rock	Silt loam	Silt loam	None	--	60"+ over volcanic ash or bedrock	Moderate	Moderate to impervious	Good	High	*IIe,IIIe* IVe,VIe VIIe	--	*Erosion*; acid soil; ashy soil	*Forest land management*
lands ountain opes)	Basic igneous rock	Clay loam	Clay loam to silty clay loam	None	--	40-72" over bedrock	Moderate	Impervious	Good	Medium and high	IIe IIIe IVe VIe	--	Erosion	Forest land management
rraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile;60 below 20-36"	20-36" over gravel and sand	Rapid	Very rapid	Somewhat excessive	Low	VIs VIIe	--	Erosion;mod. deep over gravel & sand; gravelly profile	Forest land management
plands faulted nd dis-ected lateaus)	Pumice and basic igneous rock	--	--	--	--	*20-70" over* bedrock	Very rapid	--	Excessive	Low	VIe	--	Erosion;moderately deep over bedrock; sandy profile	Continued forest land & rangeland mgmt;pastureland mgmt; drainage; irrigation management

2

Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series [2/]	Percentage of Assn. [3/]	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth
Soil Association						Classification					Soil Characteristics					
Shallow to deep soils with fine-loamy and clayey subsoils on gentle to very steep slopes.	35	1-1,500	65-75	240-280	Forest land [4/] Rangeland	Typic Haplohumults	Clayey, mixed, mesic	Orford	25	Uplands (mountainous)	Sediment-ary bed-rock	Silt loam	Silty clay loam	None	--	40-60"
					Limited cropland	Lithic Hapludalfs	Loamy, mixed, mesic	Sebastian	20	Uplands (mountainous)	Ultra basic rock	Very stony loam	Very stony clay loam	Stones	35-60 in profile	10-20" over bedrock
						Typic Dystrandepts	Ashy, mesic	Winema	15	Footslopes	Sediment-ary rock (shale and sandstone)	Silt loam	Silty clay loam over silty clay	None	--	20-60"+ over bedrock
						Typic Haplumbrepts	Fine, mixed, mesic	Knappa-heavy variant	15	Swales	Ultra basic rock	Silty clay or silty clay loam	Silty clay or clay	None	--	20-40"
	36	1,500-3,500	30-65	170-250	Forest land [4/] Limited rangeland	Ultic Haploxerults	Fine-loamy, mixed, mesic	Josephine	20	Uplands	Sediment-ary bed-rock	Silt loam	Silty clay loam	Gravel	20-35 in profile	20-40"
					Limited cropland	Ultic Haploxeralfs	Fine, mixed, mesic	Cornutt	20	Uplands	Serpentine	Clay	Clay	Gravel	10-20 in profile	40-60"
						Lithic Xerochrepts	Clayey, mixed, mesic	Pearsoll	20	Uplands (mountainous)	Ultra basic rock (serpentine)	Gravelly loam	Gravelly clay loam	Gravel	35-60 below 6"	10-20" over bedrock
						Mollic Haploxeralfs	Fine, mixed, mesic	Dole	10	Fans and terraces	Alluvium	Loam	Gravelly clay to gravelly clay loam	Gravel	10-50 in profile	40-60"
						Vertic Haploxeralfs	Fine, montmorillonitic, mesic	Peel	10	Fans and footslopes	Alluvium & residuum from serpentine bedrock	Clay	Clay	Gravel	5-20 in profile	20-40"

Table 207 - Continued

osition on ...scape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass Dryland	Range of: Major Capability Subclass Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
plands (mountain- ous)	Sediment- ary bed- rock	Silt loam	Silty clay loam	None	--	40-60"	Moderate	Very slow	Good	High	IVe VIe VIIe	--	Erosion	Forest land mgmt;restrict logging during prolonged wet periods;pastureland management
plands (mountain- ous)	Ultra basic rock	Very stony loam	Very stony clay loam	Stones	35-60 in profile	10-20" over bedrock	Moderate	Slow	Good	Low	VIIs	--	Erosion; shallow rocky soil; upset calcium/magnesium balance	Rangeland management
Footslopes	Sediment- ary rock (shale and sandstone)	Silt loam	Silty clay loam over silty clay	None	--	20-60"+ over bedrock	Moderately slow	Very slow	Good	Low and high	IIIe IVe VIe	--	Erosion;moderately deep over bedrock in places; acid soil	Pastureland management; soil amendments
Swales	Ultra basic rock	Silty clay or silty clay loam	Silty clay or clay	None	--	20-40"	Moderately slow	Very slow	Somewhat poor	Medium	IIIw IVw	--	Wetness; clayey soil upset calcium/ magnesium balance	Pastureland management; soil amendments; drainage
Uplands	Sediment- ary bed- rock	Silt loam	Silty clay loam	Gravel	20-35 in profile	20-40"	Moderate	Impervious to slow	Good	Medium	VIe VIIe	--	Erosion	Forest land mgmt;restrict logging during prolonged wet periods
Uplands	Serpentine	Clay	Clay	Gravel	10-20 in profile	40-60"	Slow	Very slow	Good	Medium to low	VIs VIIe	--	Erosion; droughtiness	Forest land mgmt;restrict logging during prolonged wet periods
Uplands (mountain- eous)	Ultra basic rock (serpentine)	Gravelly loam	Gravelly clay loam	Gravel	35-60 below 6"	10-20" over bedrock	Moderate	Slow	Somewhat excessive	Low	VIIs	--	Shallow over bedrock	Forest land mgmt;restrict logging during prolonged wet periods
Fans and terraces	Alluvium	Loam	Gravelly clay to gravelly clay loam	Gravel	10-50 in profile	40-60"	Slow	Very slow to impervious	Good	Medium to low	IVs VIe	--	Erosion; droughtiness	Forest land management; pastureland management
Fans and footslopes	Alluvium & residuum from serpen- tine bedrock	Clay	Clay	Gravel	5-20 in profile	20-40"	Slow	Very slow to impervious	Moderately good	Low	VIs	--	Erosion; droughtiness	Forest land management; rangeland management

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Table 207 - Continued

Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Pr
Moderately deep to very deep, acid soils with fine-loamy and clayey subsoils on moderate to extremely steep slopes.	37	400-2,000	60-120	150-200	Forest land[4] Cropland (hay, pasture and cereals) - dryland	Haplambrepts plus Dystrochrepts	Fine and fine-loamy, mixed, mesic	--	100	Uplands (ridgetops and steep slopes)	Sedimentary rock (sandstone and shale)	--	--	--	--	20 be
	38	100-2,000	80-120	150-200	Forest land[4] Cropland (hay and pasture) - dryland	Andic Haplumbrepts	Fine, mixed, mesic	Astoria	70	Uplands	Sedimentary rock (siltstone or shale)	Silt loam and silty clay loam	Silty clay loam & silty clay	None	--	40 be
						Typic Dystrochrepts	Fine, mixed, mesic	Melby	10	Uplands	Sedimentary rock (siltstone, shale or sandstone)	Silt loam	Silty clay	None	--	40 be
						Typic Dystrandepts	Ashy, mesic	Winema	5	Uplands (south & west facing slopes)	Sedimentary rock (shale and sandstone)	Silt loam	Silty clay loam over silt clay	None	--	20- bed
						Aquic Haplohumults	Clayey, mixed, mesic	Chitwood	3	Basins & swales	Alluvium	Silt loam	Silty clay loam & silty clay	None	--	60"
						Umbric Dystrochrepts	Loamy-skeletal, mixed, mesic	Trask	2	Uplands (ridgetops and side slopes)	Sedimentary rock	Very gravelly loam	Very gravelly loam	Gravel	35-60 in profile	10- bed
	39	500-2,000	60-70	180	Forest land	Typic Dystrochrepts	Fine, mixed, mesic	Melby	65	Uplands (gentle to steep slopes)	Sedimentary rock (siltstone, shale or sandstone)	Silt loam	Silty clay	None	--	40- bed
						Typic Haplohumults	Fine-loamy, mixed, mesic	Olyic	20	Uplands (ridgetops and steep slopes)	Basic igneous rock	Silt loam	Silty clay loam	None	--	40- bed

Table 207 - Continued

sition on ndscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass[6/]: Dryland	Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
lands ridgetops d steep lopes)	Sediment-ary rock (sand-stone and shale)	--	--	--	--	20-60"+ over bedrock	Moderate	--	Good	High	VIe	--	Erosion; clayey profile; acid soil	Continued forest land mgmt;pastureland mgmt; residue mgmt;crop. seq; cross-slope opers;restrict logging during prolonged wet periods
plands	Sediment-ary rock (siltstone or shale)	Silt loam and silty clay loam	Silty clay loam & silty clay	None	--	40-100" over bedrock	Moderate	Slow to impervious	Good	Medium and high	IVe VIe VIIe	--	Erosion; acid soil	Forest land mgmt;restrict logging during prolonged wet periods;pastureland mgmt;soil amendments
plands	Sediment-ary rock (siltstone, shale or sandstone)	Silt loam	Silty clay	None	--	40-60" over bedrock	Moderately slow	Very slow to impervious	Good	Medium and high	IIIe IVe VIe VIIe	--	Erosion; acid soil	Forest land mgmt;restrict logging during prolonged wet periods;pastureland mgmt;soil amendments
Uplands (south & west facing slopes)	Sediment-ary rock (shale and sandstone)	Silt loam	Silty clay loam over silt clay	None	--	20-60"+ over bedrock	Moderately slow	Very slow	Good	Low to high	IIIe IVe VIe	--	Erosion;moderately deep over bedrock in places;acid soil	Pastureland mgmt; soil amendments
Basins & swales	Alluvium	Silt loam	Silty clay loam & silty clay	None	--	60"+	Moderately slow	Slow	Somewhat poor	High	IIw	--	Wetness; acid soil	Drainage; soil amendments; pastureland management
Uplands (ridgetops and side slopes)	Sediment-ary rock	Very gravelly loam	Very gravel-ly loam	Gravel	35-60 in profile	10-20" over bedrock	Moderately rapid	Slow	Somewhat excessive	Low	VIe VIIe	--	Erosion;shallow over bedrock;gravelly profile;acid soil	Forest land mgmt;restrict logging during prolonged wet periods
Uplands (gentle to steep slopes)	Sediment-ary rock (siltstone, shale or sandstone)	Silt loam	Silty clay	None	--	40-60"+ over bedrock	Moderately slow	Very slow to impervious	Good	Medium and high	IIIe,IVe VIe VIIe	--	Erosion; acid soil	Forest land mgmt;restrict logging during prolonged wet periods
Uplands (ridgetops and steep slopes)	Basic igneous rock	Silt loam	Silty clay loam	None	--	40-60"+ over bedrock	Moderate	Impervious	Good	Medium and high	IIe,IIIe IVe VIe VIIe	--	Erosion; acid soil	Forest land management

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Table 207 - Continued

Soil Groups	Map Sym.	Soil Association: Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth	P
	40	1,000-2,000	75-85	170-250	Forest land[4/]	Haplohumults plus Haplumbrepts	Clayey, mixed, mesic	--	100	Uplands (mountaineous)	Sedimentary and basic bedrock	--	--	--	--	40-60"	Mo
	41	1,000-2,000	80-100	170-250	Forest land[4/]	Andic Haplumbrepts	Fine, mixed, mesic	Astoria	40	Uplands (mountain side slopes)	Sedimentary rock (siltstone or shale)	Silty clay loam or silt loam	Silty clay loam & silty clay	None	--	40-100" over bedrock	Mo
						Umbric Dystrochrepts	Loamy-skeletal, mixed, mesic	Trask	20	Uplands (mountaineous)	Sedimentary rock	Very gravelly loam	Very gravelly loam	Gravel	35-60 in profile	10-20" over bedrock	Mo ra
						Aquic Haplohumults	Clayey, mixed, mesic	Chitwood	15	Swales	Alluvium	Silt loam	Silty clay	None	--	60"+	Mo sl
	42	0-3,500	80-150	80-200	Forest land[4/] Cropland (hay and pasture and silage) - limited	Andic Haplumbrepts	Fine, mixed, mesic	Astoria	30	Uplands (steep mountainous)	Sedimentary rock (siltstone or shale)	Silt loam and silty clay loam	Silty clay or silty clay loam	None	--	40-60"+ over bedrock	Mo
						Typic Dystrochrepts	Coarse-loamy, mixed, mesic	Klone	20	Terraces	Glacial outwash	Gravelly silty loam	Gravelly silt loam	Gravel	20-35 in profile; 60 below 40-60"+	40-60"+ over gravel	Mo
Shallow, rocky miscellaneous land with very cold soils on strong to extremely steep slopes.	43	4,000-7,000	150-240	0-30	Other land Forest land[4/]	--	--	Rockland[5/]	50	Uplands (steep mountains)	Igneous & sedimentary rock	--	--	--	--	0-10" over bedrock	-
						--	--	Rough mountainous land [5/]	20	Uplands (steep mountains)	Igneous & sedimentary rock & volcanic material	Variable	Variable	Cobbles and stones	10-80 in profile	10-60"+ over bedrock	Mo i

Table 207 - Continued

Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
Uplands (mountaineous)	Sedimentary and basic bedrock	--	--	--	--	40-60"	Moderate	--	Good	Medium	VIe	--	Erosion	Continued forest land mgmt; restrict logging during prolonged wet periods; pastureland management
Uplands (mountain side slopes)	Sedimentary rock (siltstone or shale)	Silty clay loam or silt loam	Silty clay loam & silty clay	None	--	40-100" over bedrock	Moderate	Slow to impervious	Good	Medium and high	VIe VIIe	--	Erosion; acid soil	Forest land mgmt; restrict logging during prolonged wet periods
Uplands (mountaineous)	Sedimentary rock	Very gravelly loam	Very gravelly loam	Gravel	35-60 in profile	10-20" over bedrock	Moderately rapid	Slow	Somewhat excessive	Low	VIe VIIe	--	Erosion; shallow over bedrock; gravelly profile; acid soil	Forest land mgmt; restrict logging during prolonged wet periods
Swales	Alluvium	Silt loam	Silty clay	None	--	60"+	Moderately slow	Slow	Somewhat poor	High	IIw	--	Wetness; acid soil	Drainage; soil amendments; pastureland management
Uplands (steep mountainous)	Sedimentary rock (siltstone or shale)	Silt loam and silty clay loam	Silty clay or silty clay loam	None	--	40-60"+ over bedrock	Moderate	Slow to impervious	Good	Medium and high	VIe VIIe	--	Erosion; acid soil	Forest land management
Terraces	Glacial outwash	Gravelly silty loam	Gravelly silt loam	Gravel	20-35 in profile; 60 below 40-60"+	40-60"+ over gravel	Moderate	Very rapid	Good	Low and medium	VIe VIIe	--	Erosion; gravelly profile; acid soil	Forest land management
Uplands (steep mountains)	Igneous & sedimentary rock	--	--	--	--	0-10" over bedrock	--	Impervious	Good	Low	VIIIs	--	Shallow over bedrock; steep slopes	--
Uplands (steep mountains)	Igneous & sedimentary rock & volcanic material	Variable	Variable	Cobbles and stones	10-80 in profile	10-60"+ over bedrock	Moderate to impervious	Impervious	Good to poor	Low to high	VIIIe VIIIs	--	Cold climate; high elevation; steep slopes	--

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Table 207 - Continued

Soil Groups	Soil Association: Map Sym.	Soil Association: Elevation Feet	Soil Association: Precip. Inches	Soil Association: Freeze free Season Days	Soil Association: Major land use	Classification: Great Group or Subgroup	Classification: Family	Classification: Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Soil Characteristics: Texture Surface Soil	Soil Characteristics: Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth
Moderately deep to very deep soils high in quartz, with loamy subsoils on moderate to very steep slopes.	44	1,000-6,000	20-60	90-160	Forest land[4/] Cropland (pasture and hay) - irrigated	Typic Xerochrepts	Sandy, mixed, mesic	Siskiyou	65	Uplands	Acidic rock	Coarse sandy loam	Loamy very fine sand	None	--	60"+ over bedrock
						Typic Xerochrepts	Coarse-loamy, mixed, mesic	Barron	15	Terraces and fans	Alluvium	Coarse sandy loam	Coarse sandy loam	None	--	60"+
						Entic Haplumbrepts	Fine-loamy, mixed, mesic	Jerome	5	Basins & swales	Alluvium	Sandy loam	Clay loam	None	--	20-40" over clayey material
	45	2,000-6,000	50-70	80-100	Forest land[4/]	Andic Cryumbrepts	Fine-loamy, mixed	Snowlin	40	Mountainous uplands	Ash-pumice & residuum/colluvium basic rock	Gravelly loam	Clay loam	Gravel	20-35 in top 12"	60"+
						Pachic Cryoborolls	Loamy-skeletal, mixed	Prong	20	Mountainous uplands	Basic rock	Gravelly loam	Very gravelly loam	Gravel	20-60 in profile	10-20"
						Entic Cryumbrepts	Loamy-skeletal, mixed		15	Mountainous uplands	Basic rock	Gravelly loam	Very gravelly loam	Gravel	20-60 in profile	10-20"
						Typic Cryumbrepts	Coarse-loamy, mixed	Boze	10	Mountainous uplands	Basic rock	Gravelly loam	Gravelly loam	Gravel	20-35 in profile	20-40"

1/ Based on data summarized during 1966.
2/ Only soil series names that have a status as reserved, tentative, or established are listed.
3/ Differences of total percentage in each soil association from 100 percent are inclusions of other soils and land types.
4/ For the upland forest soils, the above characteristics and qualities have been extended from a limited amount of survey data. Additional data and land use interpretations for forest soils are available in the Forest Land section of Appendix VIII, Land Measures and Watershed Protection. These areas include National Forest and adjacent non-Federal forest lands.
5/ Miscellaneous land types.
6/ Presently irrigated cropland.

SOURCE: National Cooperative Soil Survey.

Table 207 - Continued

...ion	Soil Characteristics						Soil Qualities and Interpretations							
				Coarse Fragments						Total Available Water-holding	Range of: Major Capability Subclass[6/]			
...scape	Parent Material	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Capacity	Dryland	Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
...nds	Acidic rock	Coarse sandy loam	Loamy very fine sand	None	--	60"+ over bedrock	Very rapid	Impervious	Excessive	Low	VIe	--	Erosion; acid soil	Forest land management
...aces ...fans	Alluvium	Coarse sandy loam	Coarse sandy loam	None	--	60"+	Very rapid	Very rapid	Excessive	Medium	IIIs IVe VIe	IIIs	Erosion; acid soil	Forest land mgmt;pastureland mgmt;soil amendments; irrigation management
...ns & ...es	Alluvium	Sandy loam	Clay loam	None	--	20-40" over clayey material	Moderate	Slow	Somewhat poor	Medium and high	IIIw	IIIw	Wetness; acid soil	Drainage;soil amendments; pastureland mgmt; irrigation management
...tain- ...up- ...ls	Ash-pumice & residuum/ colluvium basic rock	Gravelly loam	Clay loam	Gravel	20-35 in top 12"	60"+	Moderate	Moderately slow and slow	Good	Medium	VIIe	--	Erosion	Forest land management
...tain- ...up- ...ls	Basic rock	Gravelly loam	Very gravelly loam	Gravel	20-60 in profile	10-20"	Rapid	Impervious	Good	Very low	VIIe	--	Erosion	Forest land management
...tain- ...up- ...ds	Basic rock	Gravelly loam	Very gravelly loam	Gravel	20-60 in profile	10-20"	Rapid	Impervious	Good	Very low	VIIe	--	Erosion	Forest land management
...ntain- ...up- ...ds	Basic rock	Gravelly loam	Gravelly loam	Gravel	20-35 in profile	20-40"	Rapid	Impervious	Good	Low	VIe	--	Erosion	Forest land management

...l land types.
...nt of survey data.
...ppendix VIII, Land
...ds.

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Table 208 - Soil Associations Acreage, Subregion 10, 1966

Soil Association: Map Symbol	Soil Association: Name	Oregon	Washington	Total	Percent
			(1,000 acres)		
1	Coquille-Knappa	400.0	100.0	500.0	3.3
2	Hoh-Bogachiel	-	150.0	150.0	1.0
3	Quillayute-Knappa	140.0	-	140.0	.9
4	Chehalis-Cloquato	-	190.0	190.0	1.3
5	Ruch-Newberg	140.0	-	140.0	.9
6	Hoquiam-Rockland	-	500.0	500.0	3.3
7	Shelton-Grove	-	150.0	150.0	1.0
8	Spanaway-Alderwood	-	80.0	80.0	.5
9	Alderwood-Everett	-	25.0	25.0	.2
10	Elwah-Clallam	-	45.0	45.0	.3
11	Dominantly Haplumbrepts	-	505.0	505.0	3.3
12	Haplohumults	570.0	-	570.0	3.8
13	Vader-Knappa	-	220.0	220.0	2.1
14	Steiwer-Sutherlin	200.0	-	200.0	1.3
15	Willakenzie	100.0	-	100.0	.7
16	Josephine-Ruch	1,570.0	-	1,570.0	9.8
17	Netarts-Westport	200.0	45.0	245.0	1.6
18	Cascade-Goble	5.0	-	5.0	Tr.
19	Kerby-Abegg	61.0	-	61.0	.4
20	Germany-Olympic	-	700.0	700.0	4.7
21	Nekia-Jory	90.0	-	90.0	.6
22	McCully-Kinney	75.0	-	75.0	.5
23	Agate-Rockland	43.0	-	43.0	.3
24	Climax	340.0	-	340.0	2.3
25	Carney-Coker	45.0	-	45.0	.3
26	Klickitat-Hembre	725.0	-	725.0	4.8
27	Dominantly Haploxerults	1,019.8	-	1,019.8	6.8
28	Dominantly Haploxerults	125.0	-	125.0	.8
29	Acker-Coyata	297.4	-	297.4	2.0
30	Bear Prairie-Loper	-	8.0	8.0	Tr.
31	Wilkeson-Melbourne	-	200.0	200.0	1.3
32	Steiger-Crater Lake	35.0	-	35.0	.3
33	Cinebar-Olympic	-	100.0	100.0	.7
34	Shanahan-Lapine	322.0	-	322.0	2.1
35	Orford-Sebastian	225.0	-	225.0	1.9
36	Josephine-Cornutt	230.0	-	230.0	1.5
37	Dominantly Haplumbrepts	1,390.0	-	1,390.0	9.2
38	Astoria-Melby	750.0	-	750.0	5.0
39	Melby-Olyic	35.0	-	35.0	.2
40	Dominantly Haplohumults	1,200.0	-	1,200.0	7.6
41	Astoria-Trask	190.0	-	190.0	1.3
42	Astoria-Klone	-	951.7	951.7	6.3
43	Rockland-Rough Mountainous	-	100.0	100.0	.7
44	Siskiyou-Barron	300.0	-	300.0	2.0
45	Snowlin-Prong	161.3	-	161.3	1.1
Total land area		10,984.5	4,069.7	15,054.2	100.0

Source: National Cooperative Soil Survey.

Table 209 - Summary and Distribution of Land Capability Classes, Subregion 10, 1966

Land Capability Classes	Distribution by Soil Associations1/ Soil Association Map Symbols2/	1,000 Acres	Percent	Inventoried 1,000 Acres3/
Class I - Soils in Class I have no limitations or hazards. They are adopted to all uses with a minimum of conservation treatment other than standard conditioning ones.4/	-	-	-	1.8
Class II - Soils in Class II have few limitations or hazards. Simple conservation practices are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	4-5-9	391.0	2.6	602.5
Class III - Soils in Class III have more limitations and hazards than those in Class II. They require more difficult or complex conservation practices when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	1-2-3-14-15-18-21	1,185.0	7.9	843.8
Class IV - Soils in Class IV have greater limitations and hazards than Class III. Still more difficult or complex measures are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	9-13-22-23-24-25-30-31	956.0	6.3	2,119.1
Class V - Soils in Class V have more limitations than Class IV. They are generally unsuited for cultivation, but are well suited for grazing and forestry use. They require good management practices.4/	-	-	-	-
Class VI - Soils in Class VI have severe limitations or hazards that make them generally unsuited for cultivation. They are suited largely to pasture, range, woodland or wildlife.	6-7-10-11-12-16-17-20 26-27-28-29-32-33-34 35-36-37-38-39-40-41-42	11,960.9	79.5	10,526.2
Class VII - Soils in Class VII have very severe limitations and hazards that make them generally unsuited for cultivation. They are suited to grazing, noncommercial, woodland or wildlife.	44-45	461.3	3.0	795.1
Class VIII - Soils and land forms in Class VIII have limitations and hazards that prevent their use for cultivated crops, pasture, range or woodland. They may be used for recreation, wildlife or water supply.	43	100.0	0.7	165.7
Total Land		15,054.2	100.0	15,054.2

1/ Class I and 10 percent of other capability classes may be included in areas of Class II. Up to 25 percent of other capability classes may be included in Classes III and IV. Class V and up to 40 percent of other capability classes may be included in Classes VI, VII, and VIII. In areas of rainfall less than 12 inches, large areas of Class VI can be potential Classes I through IV where irrigation water is available.
2/ Refer to the Subregional Soil Association Map, figure 43.
3/ Taken from table 8.
4/ Capability Classes I and V are distributed in small segregated areas over segments of the landscape. Many small areas could not be delineated on the map. This added detail, although still generalized, is commensurate with the subregional level of generalization.

Source: National Cooperative Soil Survey and U.S.D.A. Conservation Needs Inventory adjusted.

Classified on table 210 is the dominant water storage capacity for each soil association in Subregion 10. Each class on the table relates to a similar class on the Water Storage Capacity, figure 4. To locate those areas having contrasting water storage capacity in the upper 5 feet of soil, refer to figure 4, to figure 43, (the subregional Soil Associations Map), and to the following table. The class letter symbol in the first column and the Soil Associations Map numerical symbol listed in the second column may be used to locate those areas having contrasting water storage capacity. Complete utilization of this storage contributes a more stable and sustained streamflow.

Table 210 - Water Storage Capacity of Soils Generalized to the Soil Associations, Subregion 10, 1966

Classes of Water Storage Capacity 1/	Soil Association Symbols	1,000 Acres	Percent
Class A - Water storage in the soil profile more than 20,000 acre-feet per township.	4-13-20-37	2,500.0	16.6
Class B - Water storage in the soil profile 10,000 to 20,000 acre-feet per township.	1-2-3-5-12 14-16-18-19 21-22-31-33 35-38-39-40 41-42-28	7,277.7	48.3
Class C - Water storage in the soil profile 5,000 to 10,000 acre-feet per township.	6-7-8-9-10 11-15-24-25 26-29-30-32 36-45	3,246.7	21.6
Class D - Water storage in the soil profile less than 5,000 acre-feet per township.	17-23-43-44 27-34	2,029.8	13.5
Total		15,054.2	100.0

1/ Measurement of the Water Storage Capacity is limited to the upper 5 feet of soil or to bedrock.
Source: National Cooperative Soil Survey.

Cover and Land Use

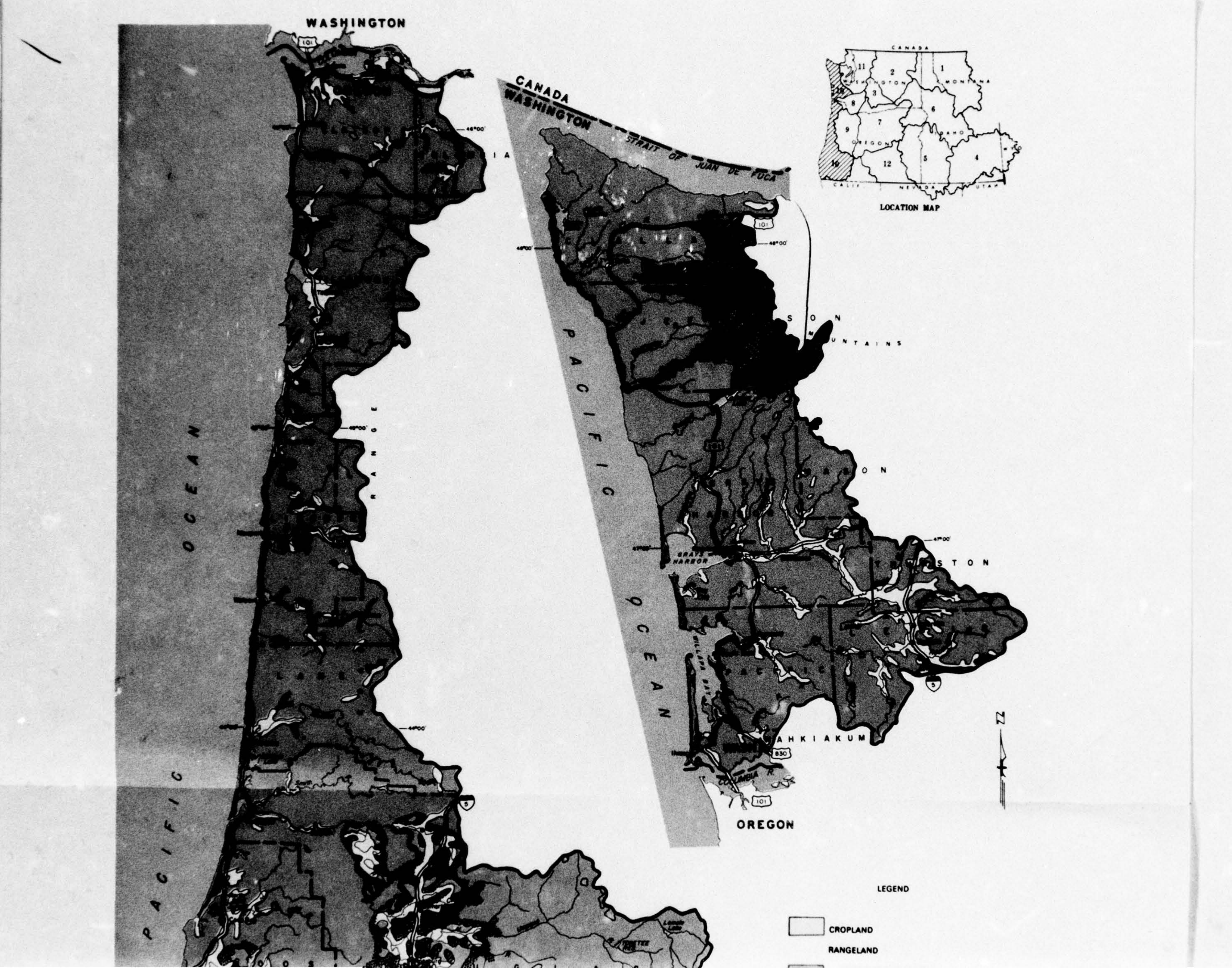
The four major cover and land uses as defined in the glossary and explained in the introduction have been summarized by acreage and ownership on tables 211 through 213. These broad categories have been determined both on the basis of cover and use. Cropland is more specifically a use category. Forest land has more than 10 percent forest cover. Rangeland areas have broad range cover characteristics. Other land includes land specifically based on use, such as urban, as well as that based specifically on cover characteristics such as barren and sand dune areas. The four major categories have been generalized for presentation on figure 44. Since this information has been generalized, isolated areas of different cover and uses may occur within the broad patterns.

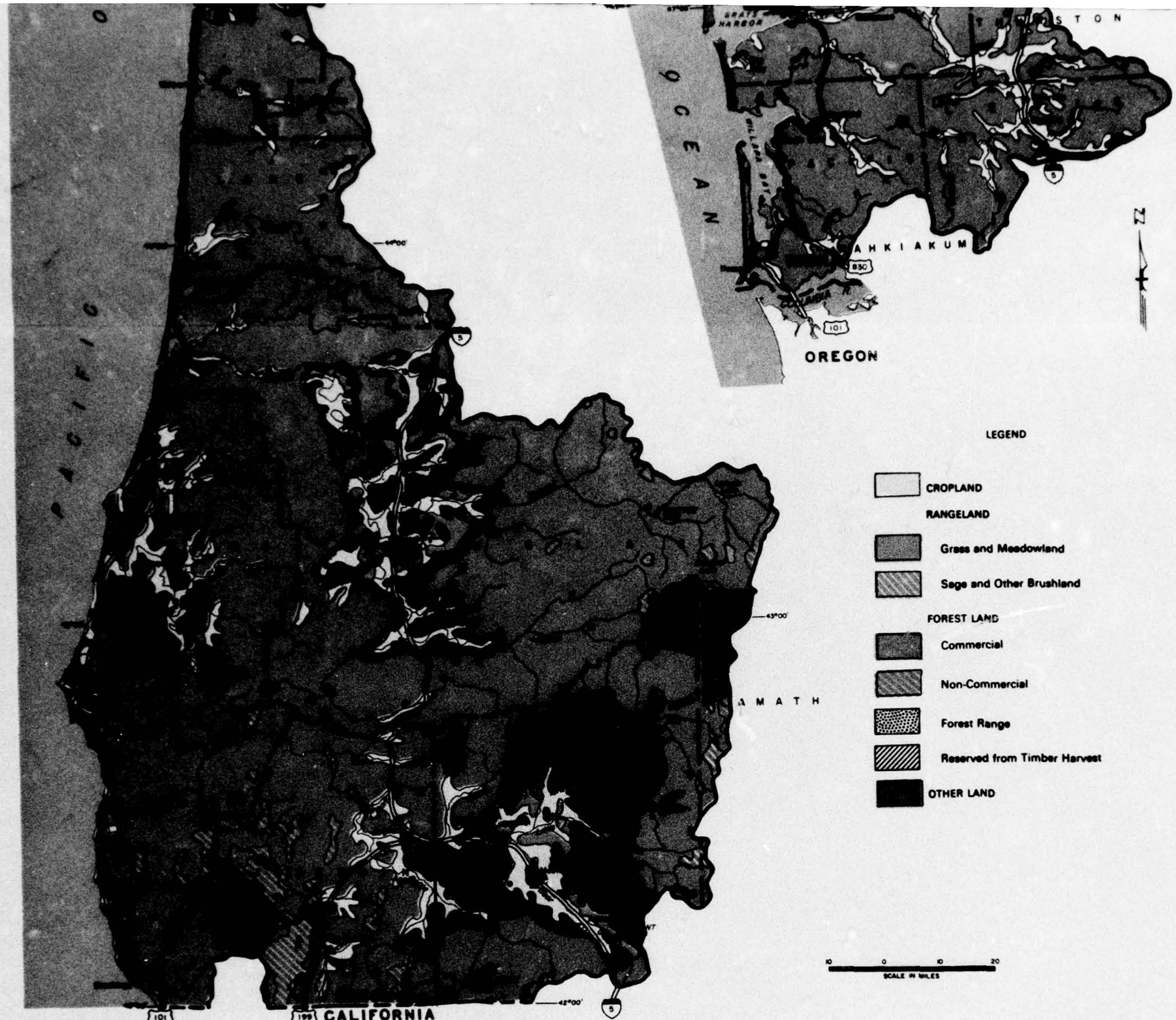
(Narrative continued on page 315)

Table 211 - Cover and Land Use by Ownership, Subregion 10, 1966

Ownership	Cropland	Forest Land	Rangeland	Other Land	Total
		(1,000 acres)			
Department of Agriculture					
Forest Service	-	3,427.1	19.6	71.0	3,517.7
Other Agriculture	-	-	-	-	-
	-	3,427.1	19.6	71.0	3,517.7
Department of the Interior					
Bureau of Land Management	-	1,772.6	62.7	3.0	1,838.3
Bureau of Indian Affairs[1/]	-	162.6	.5	4.5	167.6
National Park Service	-	503.9	8.6	66.8	579.3
Fish & Wildlife Service	-	4.0	1.0	3.7	8.7
Bureau of Reclamation	.7	4.5	2.4	1.1	8.7
Other Interior	-	-	-	.4	.4
	.7	2,447.6	75.2	79.5	2,603.0
Department of Defense	-	-	-	7.7	7.7
Other Federal	-	-	-	2.9	2.9
Federal Subtotal	.7	5,874.7	94.8	161.1	6,131.3
State	.2	1,092.8	12.0	123.9	1,228.9
County	-	129.0	-	46.8	175.8
Municipal	-	30.0	-	26.0	56.0
Public Total	.9	7,126.5	106.8	357.8	7,592.0
Private Total	583.9	6,702.1	61.8	114.4	7,462.2
Total Land Area	584.8	13,828.6	168.6	472.2	15,054.2

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.


WASHINGTON
CANADA
WASHINGTON
STRAIT OF JUAN DE FUCA
LOCATION MAP
PACIFIC OCEAN
GRAYS HARBOR
WILLAPA BAY
COLUMBIA R.
OREGON
LEGEND
CROPLAND
RANGELAND



COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

GENERALIZED COVER AND LAND USE

COASTAL, SUBREGION 10

1968

FIGURE 44

2

Table 212 - Cover and Land Use by Ownership, State of Oregon, Subregion 10, 1966

Ownership	Cropland	Forest Land	Rangeland	Other Land	Total
			(1,000 acres)		
Department of Agriculture					
Forest Service	-	3,120.3	18.6	43.0	3,181.9
Other Agriculture	-	-	-	-	-
	-	3,120.3	18.6	43.0	3,181.9
Department of the Interior					
Bureau of Land Management	-	1,770.6	62.7	3.0	1,836.3
Bureau of Indian Affairs 1/	-	-	-	-	-
National Park Service	-	63.0	-	1.4	64.4
Fish & Wildlife Service	-	-	-	.2	.2
Bureau of Reclamation	.7	4.5	2.4	1.1	8.7
Other Interior	-	-	-	.3	.3
	.7	1,838.1	65.1	6.0	1,909.9
Department of Defense	-	-	-	6.3	6.3
Other Federal	-	-	-	2.4	2.4
Federal Subtotal	.7	4,958.4	83.7	57.7	5,100.5
State	-	560.5	10.0	104.8	675.3
County	-	89.0	-	45.8	134.8
Municipal	-	19.0	-	20.7	39.7
Public Total	.7	5,626.9	93.7	229.0	5,950.3
Private Total	422.7	4,527.7	19.9	63.9	5,034.2
Total Land Area	423.4	10,154.6	113.6	292.9	10,984.5

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.

Table 213 - Cover and Land Use by Ownership, State of Washington, Subregion 10, 1966

Ownership	Cropland	Forest Land	Rangeland	Other Land	Total
			(1,000 acres)		
Department of Agriculture					
Forest Service	-	306.8	1.0	28.0	335.8
Other Agriculture	-	-	-	-	-
	-	306.8	1.0	28.0	335.8
Department of the Interior					
Bureau of Land Management	-	2.0	-	-	2.0
Bureau of Indian Affairs[1/]	-	162.6	.5	4.5	167.6
National Park Service	-	440.9	8.6	65.4	514.9
Fish & Wildlife Service	-	4.0	1.0	3.5	8.5
Bureau of Reclamation	-	-	-	-	-
Other Interior	-	-	-	.1	.1
	-	609.5	10.1	73.5	693.1
Department of Defense	-	-	-	1.4	1.4
Other Federal	-	-	-	.5	.5
Federal Subtotal	-	916.3	11.1	103.4	1,030.8
State	.2	532.3	2.0	19.1	553.6
County	-	40.0	-	1.0	41.0
Municipal	-	11.0	-	5.3	16.3
Public Total	.2	1,499.6	13.1	128.8	1,641.7
Private Total	161.2	2,174.4	41.9	50.5	2,428.0
Total Land Area	161.4	3,674.0	55.0	179.3	4,069.7

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.

Cropland

To consider cropland in the subregion, it is necessary to separate it into two distinct areas.

The coastal margin area is characterized by soil factors unique to the region. The organic matter in the soil is naturally high--generally from 9 to 22 percent. The base saturation is low--generally less than 10. The soil acidity is high--generally below pH 5.5. All of these factors contribute to the need for large applications of chemical amendments and fertilizers to the soil to create an environment suitable for most crops. These factors also restrict the range of adapted crops. Woody plants, such as special nursery crops, blueberries, and other cane fruits are naturally well adapted. The major crops are grasses and legumes for forage. So, problems of use relate to high requirements for soil amendments and fertilizers, soil wetness in low-lying areas, and problems with slow decomposition of carbonaceous crop residues. In spite of the high annual rainfall, a small application of supplemental water during the summer months increases production and efficiency of cropland use.

The Umpqua and Rogue River basins area has soil suitable for a wide range of climatically adapted crops. Most crops, cereals, tree fruit, cane fruit, and many special crops can be grown. On the valley bottoms the rather extended hot-dry season makes supplemental irrigation especially useful to increase yields and broaden the range of adapted crops. Around the margin of the valleys, foothills at somewhat higher elevations and steeper slopes are land areas less dependent on supplemental irrigation.

Soils formed over sedimentary bedrock on uplands have a good potential for either cropland or forest land use. (S.C.S. Ore 25047)

Figure 44, Cover and Land Use Map, locates in general those areas presently being used for cropland. Recorded on table 214 are acreage and extent of representative crops presently grown in Subregion 10.

Table 214 - Cropland Acreage of Representative Categories of Crops by States, Subregion 10, 1966

Categories of Crops	Oregon	Washington (1,000 acres)	Total	Percent
Dryland Cropland[1]				
Forage crops	250.0	144.7	394.7	67.5
Close grown field crops	7.0	1.2	8.2	1.4
Specialty crops[2]	4.1	2.6	6.7	1.1
Total dryland crops	261.1	148.5	409.6	70.0
Irrigated Cropland[1]				
Forage crops	136.3	8.6	144.9	24.8
Orchards and vineyards	13.1	-	13.1	2.2
Specialty crops[2]	12.9	4.3	17.2	3.0
Total irrigated crops	162.3	12.9	175.2	30.0
Total cropland	423.4	161.4	584.8	100.0

1/ Does not include other land that is irrigated (table 221).
2/ Includes bulbs, cranberries, and nursery crops.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Forest Land

Forests cover 13,828,600 acres or 92 percent of the total land area in Subregion 10. Within the subregion, 92 percent of Oregon and 91 percent of Washington are forested. This forest land dominates the landscape, covering all but the agricultural flood plains in the south and the stringer bottomlands in the north. Except in the Rogue and Umpqua drainages, there is little open grazing land between the forests and cultivated croplands.

Fifty-two percent, or over 7 million acres, of the forest land is publicly owned. Of this public land, 48 percent is national forest, 25 percent revested Oregon and California railroad grant lands and Public Domain, 9 percent other Federal holdings, and 18 percent owned by state and local governments. Forty-eight percent, or about 6.7 million acres, is privately owned; much of it in large industrial tree farms. Tables 215 through 217 outline this ownership in more detail.

Timber Nearly 13 million acres are classed as commercial forest land, about 78 percent softwood. The major species is Douglas-fir. Other species in significant quantities include western hemlock and fir. All the region's Sitka spruce and large quantities of Port Orford and western red cedar are found in this subregion. Hardwoods make up the remainder. The balance of nearly

Table 215 - Forest Land Acreage by Generalized Type and Ownership, Subregion 10, 1966

Ownership	Commercial Forest Land	Noncommercial Forest Land: Productive Reserved	Noncommercial Forest Land: Unproductive Reserved	Noncommercial Forest Land: Unproductive	Total
	(1,000 acres)				
Forest Service	3,091.1	20.0	54.8	261.2	3,427.1
Bureau of Land Management	1,747.3	-	-	25.3	1,772.6
Bureau of Indian Affairs 1/	162.5	-	-	.1	162.6
National Park Service	-	379.5	124.4	-	503.9
Fish & Wildlife Service	4.0	-	-	-	4.0
Bureau of Reclamation	2.5	-	-	2.0	4.5
Department of Defense	-	-	-	-	-
Other Federal	-	-	-	-	-
Federal Subtotal	5,007.4	399.5	179.2	288.6	5,874.7
State	1,092.8	-	-	-	1,092.8
County	128.0	-	-	1.0	129.0
Municipal	30.0	-	-	-	30.0
Public Total	6,258.2	399.5	179.2	289.6	7,126.5
Private Total	6,575.8	-	-	126.3	6,702.1
Grand Total	12,834.0	399.5	179.2	415.9	13,828.6

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest Experiment Station.

Table 216 - Forest Land Acreage by Generalized Type and Ownership, State of Oregon, Subregion 10, 1966

Ownership	Commercial Forest Land	Productive Reserved	Unproductive Reserved	Unproductive	Total
	(1,000 acres)				
Forest Service	2,812.6	20.0	54.8	232.9	3,120.3
Bureau of Land Management	1,745.6	-	-	25.0	1,770.6
Bureau of Indian Affairs 1/	-	-	-	-	-
National Park Service	-	50.0	13.0	-	63.0
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	2.5	-	-	2.0	4.5
Department of Defense	-	-	-	-	-
Other Federal	-	-	-	-	-
Federal Subtotal	4,560.7	70.0	67.8	259.9	4,958.4
State	560.5	-	-	-	560.5
County	88.0	-	-	1.0	89.0
Municipal	19.0	-	-	-	19.0
Public Total	5,228.2	70.0	67.8	260.9	5,626.9
Private Total	4,401.4	-	-	126.3	4,527.7
Grand Total	9,629.6	70.0	67.8	387.2	10,154.6

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest Experiment Station.

Table 217 - Forest Land Acreage by Generalized Type and Ownership, State of Washington, Subregion 10, 1966

	Commercial Forest Land	Noncommercial Forest Land: Productive Reserved	Noncommercial Forest Land: Unproductive Reserved	Noncommercial Forest Land: Unproductive	Total
			(1,000 acres)		
Forest Service	278.5	-	-	28.3	306.8
Bureau of Land Management	1.7	-	-	.3	2.0
Bureau of Indian Affairs1/	162.5	-	-	.1	162.6
National Park Service	-	329.5	111.4	-	440.9
Fish & Wildlife Service	4.0	-	-	-	4.0
Bureau of Reclamation	-	-	-	-	-
Department of Defense	-	-	-	-	-
Other Federal	-	-	-	-	-
Federal Subtotal	446.7	329.5	111.4	28.7	916.3
State	532.3	-	-	-	532.3
County	40.0	-	-	-	40.0
Municipal	11.0	-	-	-	11.0
Public Total	1,030.0	329.5	111.4	28.7	1,499.6
Private Total	2,174.4	-	-	-	2,174.4
Grand Total	3,204.4	329.5	111.4	28.7	3,674.0

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest Experiment Station.

1 million acres is classed as noncommercial forest, 40 percent on lands reserved from timber harvest, the balance in the nonproductive category.

Sixty-one percent of the commercial forest area is in the sawtimber class. Eleven percent is classed as pole timber and 22 percent saplings and seedlings; 6 percent is nonstocked. This subregion has nearly a third of its forest land in second-growth stands, indicative of its history of early day logging activity. Nearly 400,000 acres of the commercial forest land have been reserved from timber harvest by park and wilderness type classifications. The nonreserved balance supports over 260 billion board feet of commercial sawtimber, supplying raw material for a forest industry which furnishes 83 percent of the manufacturing employment.

Forest Range The forest range includes nearly 1.9 million acres classified as commercial forest land and 108,000 acres are noncommercial. These 2.0 million acres represent 14 percent of the total forest land. Grazed forest land is usually cutover areas of brush or timber adjacent to other agricultural areas. Larger areas of grazed forest land are located in the Rogue and Umpqua basins and adjacent to the Coquille River in southern Oregon.

Smaller areas of forest range are found throughout the length of the Coastal Range in stringers following the numerous stream bottoms and interspersed with small patches of cultivated lands.

The forest range varies from relatively open 10 percent timber stands to completely stocked timber cover. Slopes vary from gentle to moderately steep except in areas with intermingled cropland where the gentler slopes are cleared for cropland leaving the steeper slopes in forest. Livestock forage is generally of low quality, mostly brush but with some good pasture in small openings at the bottom. In the high mountains, open meadows, sub-alpine glades, and grassy hillsides and ridges in the forest zone furnish excellent summer range.

It is estimated that only 10 percent of the forest range is in good condition, 29 percent in fair condition, and 61 percent in poor condition. About 79 percent of the forest range in Subregion 10 is in private ownership and the remainder is managed by the Federal Government.

Other Uses Although this is the number one timber producing subregion, its forest lands are extremely important for other purposes. Over 93 percent of the subregion's runoff originates here. Domestic water supply systems furnishing water for nearly all the subregion's urban population are located on these forested watersheds.

The forest lands also furnish the environment for a significant portion of the recreation use, providing areas for hunting, fishing, sightseeing, and other outdoor activities. The public forest land furnished areas and facilities for over 14 million recreation visits in 1965. These included use at developed recreation sites, beach areas, and the general forest environment. The private forest land furnished areas and facilities for another 150,000 visits during this period. The forests are the key habitat for the deer, elk, and small game species. About 800,000 hunter visits were recorded on forest areas in 1965.

Rangeland

In Subregion 10 rangeland amounts to 169,000 acres and represents about 1 percent of the total land area. This subregion accounts for less than 1 percent of all nonforest rangeland in the region. Tables 218 through 220 show the different categories of rangeland by ownership and state.

Most of the range is found in small parcels intermingled with valley bottom cropland and with higher elevation forest lands.

Table 218 - Rangeland and Forest Range Acreage by Range Type and Ownership, Subregion 10, 1966

Category	Federal					Non-Federal		
	BLM	FS	BIA	Other (1,000 acres)	Total	State & County	Private	Total
Rangeland								
Grasslands	25.0	11.9	.3	7.8	45.0	10.0	46.3	101.3
Sagebrush	-	-	-	-	-	-	-	-
Brushland other than sage	37.7	7.7	.2	4.2	49.8	2.0	15.5	67.3
Total	62.7	19.6	.5	12.0	94.8	12.0	61.8	168.6
Forest Range1/								
Commercial Forest	339.8	34.8	-	-	374.6	-	1,481.5	1,856.1
Noncommercial Forest								
Sub-alpine	25.0	5.3	-	-	30.3	-	70.8	101.1
Desert Fringe	-	.8	-	-	.8	-	6.0	6.8
Total (noncommercial)	25.0	6.1	-	-	31.1	-	76.8	107.9
Total (forest range)	364.8	40.9	-	-	405.7	-	1,558.3	1,964.0
Grand Total	427.5	60.5	.5	12.0	500.5	12.0	1,620.1	2,132.6

1/ Forest and woodland grazed or potentially usable for forage production. Forest range acreage is included within the total forest statistics shown on table 215.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Table 219 - Rangeland and Forest Range Acreage by Range Type and Ownership, Subregion 10, State of Oregon, 1966

Category	Federal					Non-Federal		
	BLM	FS	BIA	Other (1,000 acres)	Total	State & County	Private	Total
Rangeland								
Grasslands	25.0	11.4	-	1.2	37.6	8.5	16.9	63.0
Sagebrush	-	-	-	-	-	-	-	-
Brushland other than sage	37.7	7.2	-	1.2	46.1	1.5	3.0	50.6
Total	62.7	18.6	-	2.4	83.7	10.0	19.9	113.6
Forest Range1/								
Commercial Forest	339.8	34.8	-	-	374.6	-	1,459.3	1,833.9
Noncommercial Forest								
Sub-alpine	25.0	5.3	-	-	30.3	-	70.8	101.1
Desert Fringe	-	.8	-	-	.8	-	6.0	6.8
Total (noncommercial)	25.0	6.1	-	-	31.1	-	76.8	107.9
Total (forest range)	364.8	40.9	-	-	405.7	-	1,536.1	1,941.8
Grand Total	427.5	59.5	-	2.4	489.4	10.0	1,556.0	2,055.4

1/ Forest and woodland grazed or potentially usable for forage production. Forest range acreage is included within the total forest statistics shown in table 215.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Table 220 - Rangeland Forest Range Acreage by Range Type and Ownership, State of Washington, Subregion 10, 1966

Category	Federal					Non-Federal		
	BLM	FS	BIA	Other (1,000 acres)	Total	State & County	Private	Total
Rangeland								
Grasslands	-	.5	.3	6.6	7.4	1.5	29.4	38.3
Sagebrush	-	-	-	-	-	-	-	-
Brushland other than sage	-	.5	.2	3.0	3.7	.5	12.5	16.7
Total	-	1.0	.5	9.6	11.1	2.0	41.9	55.0
Forest Range1/								
Commercial Forest	-	-	-	-	-	-	22.2	22.2
Noncommercial Forest								
Sub-alpine	-	-	-	-	-	-	-	-
Desert Fringe	-	-	-	-	-	-	-	-
Total (noncommercial)	-	-	-	-	-	-	-	-
Total (forest range)	-	-	-	-	-	-	-	-
Grand Total	-	1.0	.5	9.6	11.1	2.0	64.1	77.2

1/ Forest and woodland grazed or potentially usable for forage production. Forest range acreage is included within the total forest statistics shown on table 215.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Small concentrations are located in the Rogue and Umpqua basins and the south coastal area of Oregon. The rangeland includes some isolated areas of prairie type grassland on which trees or brush have never grown and previous forest land which has been converted to grazing by logging, burning, and seeding to perennial grasses or mixtures of grasses and legumes. About two-thirds of the rangeland consists of grasslands and the remainder is brushland, with many areas containing a mixture of both.

About 15 percent of the range is in good condition, 32 percent is in fair condition, and 53 percent is in poor condition.

Nearly two-thirds of the rangeland is under Federal control and the remainder is in private or state ownership.

Other Land

The other land use in the Coastal Subregion consists of 472,200 acres or about 3 percent of the land area. This includes barren land and rock that make up about 46 percent of the total. Almost 40 percent of the total is urban, industriai areas, farmsteads, airports, roads, and other miscellaneous use areas. About 14 percent consists of water areas less than 40 acres and streams less than one-eighth mile wide. Table 221 shows the acreage and extent of other land in the Coastal Subregion.

Coastal sand dunes encroaching on forest and water areas are presently useful for recreation and timber production. Stabilization of sand would protect forest and water areas. (Forest Service)

Table 221 - Other Land, Subregion 10, 1966

Kinds of Land Use	Oregon	Washington	Total	Percent
	(1,000 acres)			
Barren	110.4	106.2	216.6	45.8
Roads and railroads	43.1	20.9	64.0	13.6
Small water 1/	60.7	6.6	67.3	14.3
Miscellaneous 2/	78.7	45.6	124.3	26.3
Total other land	292.9	179.3	472.2	100.0

1/ Water areas less than 40 acres in size and streams less than one-eighth mile in width.

2/ Includes urban and industrial areas, farmsteads, airports, and other areas.

Source: Compiled by the Soil Conservation Service River Basin Staff

MINERAL RESOURCES

Metals

The subregion is underlain predominately by volcanic rocks interspersed by marine and continental sedimentary rocks. Marine sediments of Mesozoic and/or Tertiary age underlie a large part of the Olympic Mountains; and sediments, metasediments, metavolcanics, and metamorphics of Mesozoic and late Paleozoic age underlie most of the Klamath Mountains. The Klamath Mountain province also contains many intrusive plutonic rocks of both granitic and ultramafic composition in the form of dikes, sills, plugs, and small batholiths. The metallic mineral deposits are associated with these intrusive bodies, and thus most of the metals are found in Coos, Curry, Josephine, Douglas, and Jackson counties in the southern portion of the subregion. Deposits of manganese and a few other metals are associated with basic intrusions in Clallam and Grays Harbor counties in the northern part.

As in other parts of the Columbia-North Pacific, the early prospectors and miners were seeking gold (mostly as placer deposits). Some of the earliest placer discoveries in the Northwest were made on Jackson Creek (1851) near Medford, and on the Illinois River in 1851. Development of gold mining and gold production was outstanding in the period 1850-1870 in the Upper Rogue River drainage, mostly from placer operations with some rich lode deposits. In the 1860's placer mining was active on Wolf, Graves, Bear, Althouse, Sucker, Sardine, Evans, and Trail creeks, the Applegate River, and on the main stem of the Rogue River. Most of the richest bar placers were depleted or exhausted by 1870. Extensive hydraulic and dredge mining continued on terrace and bench gravel placers until 1942 when all gold mining ceased due to wartime Government regulations. Lode gold deposits in the Rogue River drainage were not as productive as the placers, although some very high grade "pockets" were worked. The famous Gold Hill pocket was discovered in 1859 and yielded about $400,000 in gold value during the 1860's. The Applegate and Upper Rogue River drainage in Jackson County contains several mining districts that have produced significant amounts of gold.

The Ashland District is in the Bear Creek drainage in south-central Jackson County (figure 45). The Ashland mine was the most important lode gold mine in the district. Placer mining, starting in 1858, was the principal source of gold production for about 20 years. Total production from the district is estimated to be 8,700 ounces of gold, 3,000 ounces of silver, and 1.5 tons of copper (table 222).

The Gold Hill District is in the Upper Rogue River drainage in northwestern Jackson County. Placer mining has accounted for most of the gold production and dredging has been an important part of the placer operations. A few lode gold mines accounted for a significant output. Limestone was produced near Gold Hill for cement manufacture and a high-grade silica rock deposit is quarried and crushed in a plant at Rogue River. Several hundred flasks of mercury have come from deposits in the Evans Creek drainage in the northeastern part of the district. Total production from the district has been about 84,200 ounces of gold, 16,000 ounces of silver, a small amount of copper and lead, and 750 flasks of mercury.

Some of the earliest gold discoveries in Oregon were in the Jacksonville District in 1851. The district is in the Bear Creek drainage. Some extremely rich "pockets" of gold ore were found but most of the production came from placer deposits. Many residents in Jacksonville mined the gold bearing gravel in their back yards. Coal beds are also present in the district, and coal has been produced southeast of Medford for local household heating. The total production from the district has been about 14,000 ounces of gold, 14,500 ounces of silver, and 3.5 tons of copper.

The Upper Applegate District is in the Upper Applegate drainage near the California border in Jackson County. The center of the district and the most productive area is near the mouth of Forest Creek. Most of the gold has come from placer deposits. Antimony and mercury deposits also occur in the district. Gold placer mining was active until about 1942. Total production from the district has been approximately 6,000 ounces of gold, 1,000 ounces of silver, and a little copper, lead, antimony, and mercury.

The Middle Rogue River drainage in Josephine County has also been a metallic mineral producing area.

The Galice District is in northwestern Josephine County in the Middle Rogue River drainage. Gold, silver, copper, and lead have come from lode deposits. Placer gold deposits were most productive between 1850 and 1880. The Almeda mine was one of the most important producers. Total production of the district is estimated at about 43,000 ounces of gold, 52,000 ounces of silver, 135 tons of copper, and 3.2 tons of lead.

Table 222 - Mining Districts, Subregion 10

Index No. Fig.	District	County	Drainage	Size of Districts - Production Plus Potential Reserves 1/ Gold	Silver	Copper	Lead	Zinc	References
		Oregon							
1	Ashland	Jackson	Bear Creek, a tributary to the Rogue River	3 1/	3 1/	3 1/	-	-	Parks, H.M. and Swartley, A.M., 1916, Oreg. Bur.Mines and Geol., Mineral Resources of Oregon, vol. 2, No. 4
2	Gold Hill	do	Upper Rogue River including Grave Creek, Evans Creek, Sardine Creek	1 750 flasks of mercury from Evans Creek mercury district	2	3	3 1/	-	do Callaghan, E. and Buddington, A.F., 1938, U.S.Geol.Surv. Bull. 893. Wells, F.G. and Waters, A.C., 1934, U.S.Geol. Survey Bull. 850
3	Jacksonville	do	Bear Creek, tributary to Rogue River	2 Some coal production from the Rogue River coal field.	2	3	3	-	Parks and Swartley, 1916 Yancey, H.F. and Geer, M.R., 1940 Oreg. Dept. of Geol. & Mineral Industries Bull. 20
4	Upper Applegate	Oregon Jackson	Upper Applegate River Tributary to Rogue River	3 Small production of mercury and antimony	3	3	3	-	Parks and Swartley, 1916. Schuette, C.N., 1938, Oreg.Dept. of Geol. and Mineral Industries Bull. 4
5	Galice	Josephine	Middle Rogue River and tributaries including Galice, Jump-Off-Joe, and Louse Creeks	2	2	2	2	-	Parks and Swartley, 1916. Diller, J.S., 1914, U.S.Geol. Survey Bull. 546.
6	Grants Pass	do	Middle Rogue River and tributaries including Pickett Creek	2 A small amount of manganese produced during war years (1940-45).	3	3	-	-	Parks and Swartley, 1916. Diller, J.S. and Kay, G.F., 1909, U.S.Geol.Survey Bull.380
7	Greenback	do	Wolf and Grave Creeks, tributaries to Rogue River	1 A small amount of manganese and chrome produced during war years (1940-45).	2	3	-	-	Parks and Swartley, 1916. Libbey, F.W., and others, 1942. Oreg. Dept. of Geol. & Mineral Industries Bull. 17.
8	Illinois River	Josephine	Illinois River and its tributaries	2 Several thousand tons of chromite produced during war years (1940-45).	3	3	-	-	Parks and Swartley, 1916. Diller, 1914. Allen, J.E., 1938, Oregon Dept. of Geol. and Mineral Resources. Bull. 9

Table 222 - continued

				Au	Ag	Cu	Pb	Zn	Remarks	References
9	Lower Applegate	do	Lower Applegate and its tributaries including Williams Creek and Missouri Flats	2	3	3	3	-	Small chromite production and important limestone quarries.	Parks and Swartley, 1916. Allen, 1938
10	Waldo	do	Sucker Creek and its tributaries	1	2	1	-	-		Parks and Swartley, 1916. Shenon, P.J., 1933, U.S.Geol.Survey Circ. 2.
11	Riddle	Douglas	Cow Creek and its tributaries	3	2	2	3	-	Largest producer of nickel in the Nation. Total production, more than 100,000 tons of nickel.	Parks and Swartley, 1916; Shenon, 1933; Oregon Dept. of Geol. & Mineral Industries, Ore-Bin, vol. 15, No. 10.
12	Nonpariel-Bonanza (Mercury)	Douglas	North Umpqua River and its tributaries						Has produced nearly 40,000 flasks of mercury, mostly from the Bonanza mine	Brooks, H.C., 1963, Oregon Dept. of Geol. & Mineral Industries, Bull. 55.
13	Coos	Coos	Coos River	3	3	-	-	-	Has produced about 2.5 million tons of coal from Coos Bay coal field and some chromite from beach deposits.	Pardee, J.T., 1934, U.S. Geol.Survey, Circular 8, Yancey and Geer, 1940. Libby, F.W., 1938, Oregon Dept. of Geol. & Mineral Resources, Bull. 2.
14	Chetco	Curry	Chetco, Winchuck, and Pistol Rivers and their tributaries	3	3	-	-	-	Some manganese and chromite produced during war years (1940-45).	Parks and Swartley, 1916. Allen, 1938.
15	Gold Beach-Agness	do	Pistol River, Lower Rogue River and Hunter Creek	3	3	-	-	-	Red Flats laterite deposits contain reserves of iron-nickel.	Parks and Swartley, 1916. Hundhausen, R.J. and others, 1954, U.S. BuMines Rept. of Invest. 5072.
16	Sixes River	Curry	Sixes and Elk Rivers and their tributaries	2	3	3	-	-		Parks and Swartley, 1916.
		Washington								
17	Crescent	Clallum	Soleduck River and tributaries, Olympic Penn.						Estimated 52,000 tons of manganese ore produced	Magill, E.A., 1960, U.S. BuMines Rept. of Invest. 5530

1/ Size

index	Gold (Troy Ounces)	Silver (Troy Ounces)	Copper (Net Tons)	Lead (Net Tons)	Zinc (Net Tons)
1	50,000 - 200,000	100,000 - 1,000,000	1,000 - 10,000	50 - 500	50 - 500
2	10,000 - 50,000	10,000 - 100,000	100 - 1,000	5 - 50	5 - 50
3	Less than 10,000	Less than 10,000	Less than 100	Less than 5	Less than 5

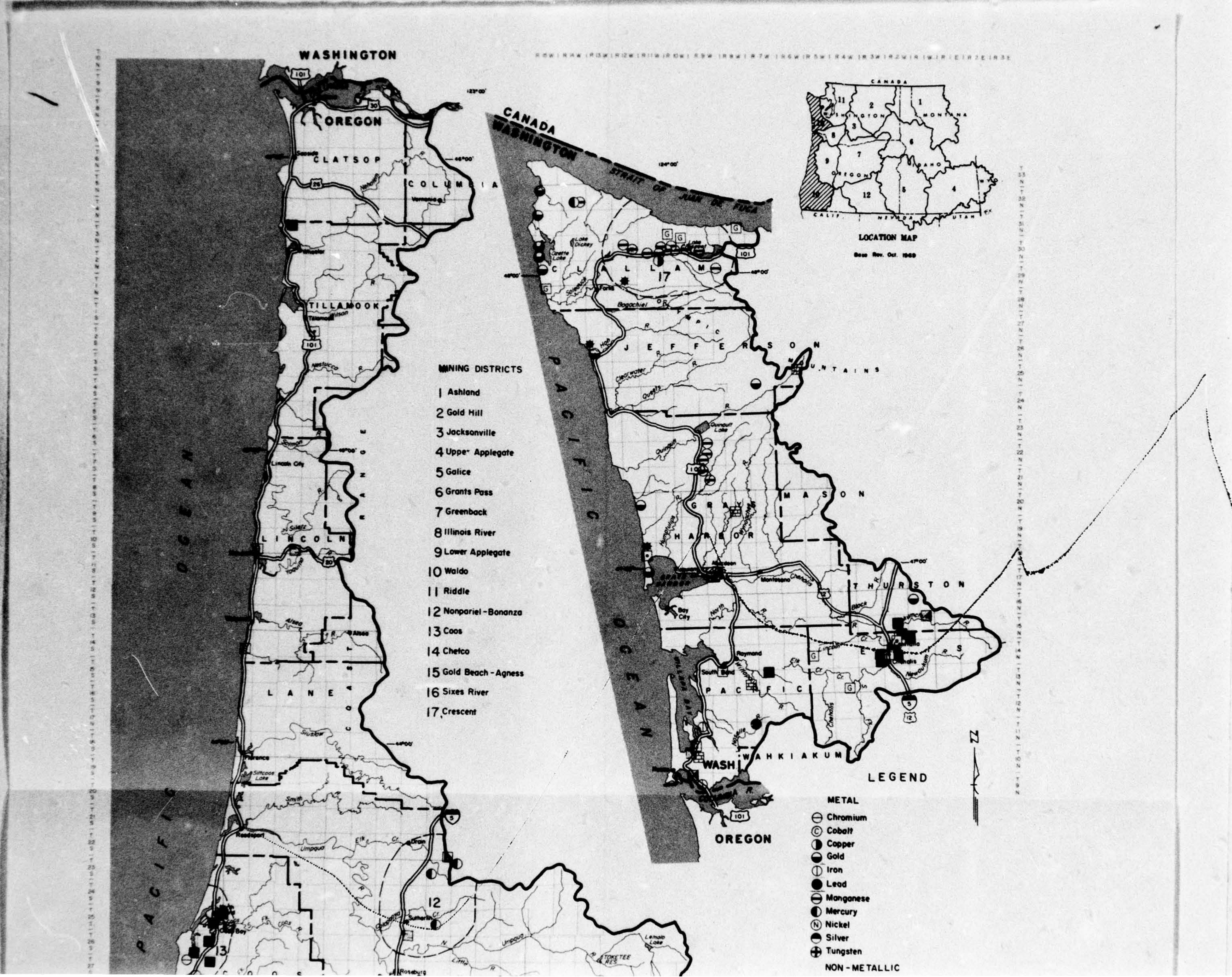
The Grants Pass District is in the drainage of the Rogue River in Josephine County above the mouth of Jump-Off-Joe Creek. Several gold lode and placer deposits have been productive. There was some output up to 1942. Manganese, chrome, and copper prospects are found in the district, but production of these metals has been very small. Total production is estimated to be about 18,000 ounces of gold, 2,000 ounces of silver, and 6 tons of copper.

The Greenback District is in the Wolf and Grave Creek drainages in northeastern Josephine County. Placer and lode deposits have produced significant amounts of gold, and were productive until 1942. Deposits of manganese and chrome were worked during World War II, but the mines were closed shortly after the end of the war. Total production for the district was about 89,000 ounces of gold, 36,000 ounces of silver, a small amount of copper, manganese, and chrome.

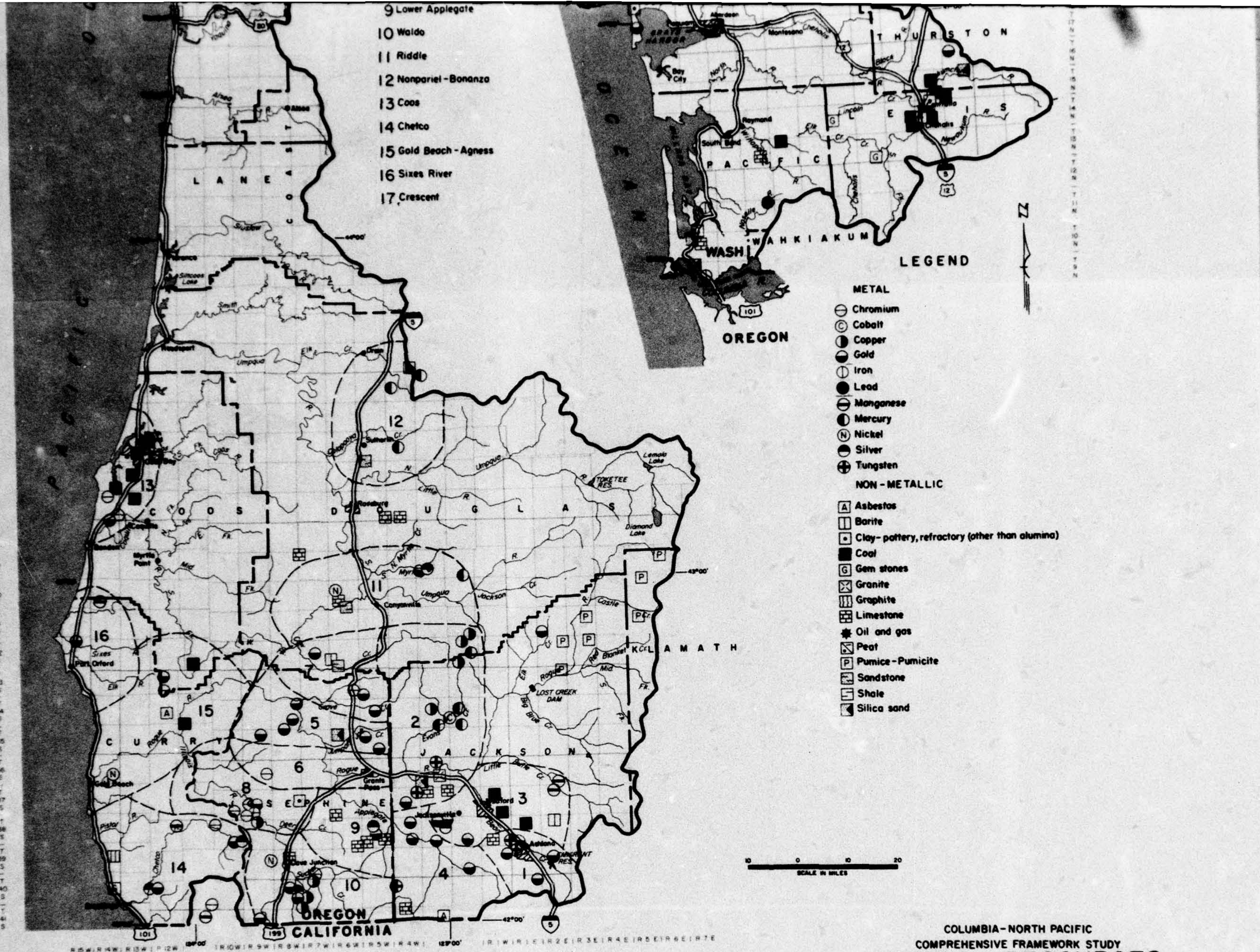
The Illinois River District includes the drainage of the Illinois River and its tributaries in Josephine County. Gold lode and placer deposits have been worked; the placer deposits have been the most productive. Some platinum has been recovered with the placer gold. During the 1940's interest in chromite deposits in this district was stimulated by a Government purchasing program with an ore purchasing depot at Grants Pass. Several deposits were developed and some chromite was produced. The total metal production in the district was about 10,000 ounces of gold, 1,000 ounces of silver, 12 tons of copper, and several thousand tons of chromite.

The Lower Applegate District includes the drainage of the Lower Applegate River and its tributaries in Josephine County. Placer mining began in the Lower Applegate shortly after gold was discovered on Josephine Creek in 1852. Several gold lode deposits were discovered in the district but production from this source has been minor. The Marble Mountain limestone deposits have been worked for cement rock for a cement plant at Gold Hill and another deposit has produced lime rock for chemical grade lime. Total production in the district was about 13,000 ounces of gold, 2,000 ounces of silver, and a small production of copper.

The Waldo District includes the drainages of Sucker Creek and its tributaries in southern Josephine County. Gold placers on Sucker Creek were mined extensively in the 1850's and 60's and lode mining started with the discovery of the Waldo Copper mine in 1860. The Queen of Bronze mine was an important copper producer in the period 1904 to 1929. There has been some platinum output as a byproduct of the placer mining operations. Total production has been about 58,000 ounces of gold, 12,000 ounces of silver, and 3,243 tons of copper.



WASHINGTON
OREGON
CLATSOP
COLUMBIA
TILLAMOOK
LINCOLN
LANE
COAST RANGE
PACIFIC OCEAN
CANADA
WASHINGTON
STRAIT OF JUAN DE FUCA
CLALLAM
17
JEFFERSON
OLYMPIC MOUNTAINS
MASON
GRAYS HARBOR
THURSTON
LEWIS
PACIFIC
WAHKIAKUM
WASH
OREGON
12
13
LOCATION MAP
Base Rev. Oct. 1969
MINING DISTRICTS
1 Ashland
2 Gold Hill
3 Jacksonville
4 Upper Applegate
5 Galice
6 Grants Pass
7 Greenback
8 Illinois River
9 Lower Applegate
10 Waldo
11 Riddle
12 Nonpariel-Bonanza
13 Coos
14 Chetco
15 Gold Beach-Agness
16 Sixes River
17 Crescent
LEGEND
METAL
Chromium
Cobalt
Copper
Gold
Iron
Lead
Manganese
Mercury
Nickel
Silver
Tungsten
NON-METALLIC



COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

MINERAL RESOURCES AND MINING DISTRICTS

COASTAL, SUBREGION 10

FIGURE 45

2

The Riddle District in Douglas County includes the drainage of Cow Creek and its tributaries. Nickel Mountain near Riddle is the largest nickel producer in the Nation. In addition, gold is found in lodes and placer deposits and copper occurs in the western part of the district. Total production has been about 7,000 ounces of gold, 24,000 ounces of silver, 395 tons of copper, more than 150,000 tons of nickel, and a small amount of lead.

The Nonpariel-Bonanza District is located in the North Umpqua River drainage. This district has been the largest mercury producer in Oregon with a record output of nearly 40,000 flasks.

The Coos District is in Coos River drainage and the coastal area of Coos County. It has produced a small amount of gold, silver, chromite, and platinum from beach and terrace deposits. About 2,500,000 tons of coal were produced from the Coos Bay coal field prior to 1920.

The Chetco District is located in the Chetco, Winchuck and Pistol River drainages. There are extensive areas of serpentine and greenstone in this district containing deposits of chromite, some of which have been productive on a small scale during times of high prices or Government subsidy. Some gold and silver have come from placer deposits along with minor amounts of platinum. Production has been about 7,000 ounces of gold, 1,000 ounces of silver, and several thousand tons of chromite.

The Gold Beach-Agness District includes the lower Rogue River and Hunter Creek drainages. Mining has been predominately confined to the beaches and elevated beaches or terraces near the coastline. The Red Flats laterite deposits are presently under investigation as a source of nickel. A small amount of gold and silver has come from the placer workings.

The Sixes River District includes the drainages of the Sixes and Elk rivers. This district has seen considerable activity in the past. Gold, silver, platinum, and copper have been produced sporadically.

The Olympic Peninsula contains numerous deposits of manganese The Crescent District in the Soleduck River drainage has been by far the most productive, due principally to the Crescent mine, where the output has been about 52,000 tons of manganese ore.

Present Mineral Industry and Outlook for the Future

Metals

Gold From 1850 to about 1940, gold was the principal metal produced in Subregion 10. The mining districts in Jackson, Josephine, and Douglas counties, principally in the Rogue River drainage, were among the most productive in Oregon. The earliest gold mining in Oregon was in Jackson and Josephine counties in 1851. Because of wartime conditions and by Government order, gold mining virtually ceased in 1942 and has not regained any real importance since removal of Government restrictions after the war.

The present gold production is at an alltime low. Production for Oregon in 1966 was 281 troy ounces, most of it from Josephine, Jackson, and Grant counties. The largest producer was in Josephine County. With a substantial increase in the price, the outlook for gold production could improve.

Silver The silver production has been primarily a byproduct from gold and copper ores. Small silver production was reported for Jackson and Josephine counties in 1965 and 1966. Future potential for production depends on the future gold and copper production.

Copper Copper was produced prior to World War II in Josephine and Douglas counties; however, there has been virtually no copper production since the war. The outlook for future copper output is not good as known reserves are mostly depleted.

Mercury The Bonanza-Nonpariel mercury district, Douglas County, has produced more mercury than any other district in Oregon. The Bonanza mine, near Sutherlin, has produced nearly 40,000 flasks of mercury. The mine was closed in 1960 due to depleted ore reserves. During 1966, a few flasks of mercury were produced in Douglas and Jackson counties. The outlook for future mercury production is favorable as lower grade reserves become economic due to the higher market price.

Nickel The Riddle District, Douglas County, is noteworthy as having the only producing nickel mine in the Nation. The Nickel Mountain deposit has produced more than 150,000 tons of contained nickel since 1954. Annual production recently has been 12,000 to 14,000 tons of contained nickel from about 1 million tons of mined ore. Estimated reserves are sufficient for 10 to 15 years of output at the present annual rate of production.

Chromite Chromite has been produced in Coos, Curry, Jackson, Josephine, and Douglas counties. Production has been mainly for Government stockpiles during times of national emergencies when foreign sources were in jeopardy. The size and quality of the deposits cannot compete with other sources of supply, particularly overseas, during normal periods of competition.

Manganese Manganese deposits are numerous on the Olympic Peninsula, particularly in Clallam County. The Crescent mine produced about 52,000 tons of manganese ore containing 35 percent or more MnO_2. The potential resources of manganese have not been thoroughly explored; however, a period of strategic need, such as occurred during the World War II period, might start another productive period. There is presently little or no production.

Iron and Titanium The beach sands along the Oregon and Washington coast and in the Columbia River estuary contain concentrations of "black sands" with considerable iron and titanium. There has been extensive testing of these deposits and a potential exists for future production.

Nonmetals

Sand and Gravel Sand and gravel ranked first in value of mineral products in 1965 for Clallam, Grays Harbor, Curry, and Josephine counties. It is generally a ubiquitous material occurring as river bars and terraces and as ocean beach deposits. Commercial sand and gravel operations are located close to metropolitan areas where a market exists for the products. It is used largely for aggregate in concrete. The reserves of sand and gravel are very large, but, locally, sources may become scarce or inadequate because of competing land uses.

Stone Crushed stone (mostly basalt), despite its low unit price, is a most valuable mineral commodity. Quarries are generally located at the most accessible sites and as close as possible to the point of utilization or market. Crushed stone is used for roadstone and aggregate. Within the subregion, stone ranked first in value of minerals produced in 1965 for Coos, Clatsop, Lincoln, Tillamook, Columbia, Jefferson, Lewis, Mason, and Pacific counties. Quartz rock (silica) is mined in Jackson County near Rogue River and in Douglas County for industrial uses, roofing granules, and poultry grit.

Peat A minor amount of peat is produced, mostly in Mason County. Much larger deposits are present in subregion 11 and principal production is in that area.

Gem Stone Agate and jasper are found on the beaches in Oregon and Washington. These stones are collected by tourists and "rockhounds" and add considerable income to the recreational industry in these states. There are no commercial operations.

Mineral Fuels

Coal Present coal production is virtually nonexistent; however, the outlook for future production is very good. A strip of mine operation is being prepared in the Centralia-Chehalis coal field in Thurston and Lewis counties to supply fuel for a major thermal-electric power plant to be erected nearby. The power plant will ultimately have two generating units of 700,000 kilowatts each; the first unit is scheduled to go into operation in 1971. The annual fuel required for one unit will be 3,500,000 tons, and for two units, 6,500,000 tons. Coal reserves are estimated to be 500 million tons, of which 150 million tons are mineable under present economic and technologic conditions.

Petroleum Exploratory wells have been drilled in Clallam, Jefferson, and Grays Harbor counties, Washington; four wells in the Ocean City area produced a small amount of oil; however, none of the discoveries have been considered as commercial discoveries. Offshore oil and gas exploration is in progress, both in Washington and Oregon.

SUBREGION 11
PUGET SOUND

ABSTRACT

The Puget Sound is one of the four smaller subregions; specifically it ranks number nine in size and is located completely in Northwest Washington State.

There are three kinds of landscapes that affect the kind and intensity of use. They are: the bottomlands; terraces, fans, and foothills; and the mountains.

The bottomlands occur along the lower course of major streams. They include some low terraces, but are dominantly nearly level areas of soils formed in alluvial sediments. Major problems of use relate to soil wetness and overflow during prolonged wet periods. Most of this area is cropland producing forage for the dairy industry. In selected areas of suitable soil and drainage, a wide range of high value crops are produced.

The terraces, fans, and foothills have soils formed mostly in glacial material. Major problems of use relate to compacted or cemented layers in the parent material, presence of gravel, cobbles and stones, and limited strong to steeply sloping areas. Much of the urban and rural population is concentrated in this area. Many cropland patches are interspersed between areas of forest land. A wide range of adapted crops are grown.

The high mountains on the east and west-central sides are covered with forest, snowfields, or bare rock. The use is generally restricted to forest land, watershed, recreation, or for aesthetics. Soils were formed in a mixture of volcanic material (ash, pumice, or other ejecta) residuum/colluvium from basic or sedimentary bedrock and glacial material. Major problems of use relate to very steep and precipitous slopes, cobbles and stones, and restricted depth to impervious strata. Forest land use and management on this area are generally at a medium level of intensity.

Subregion 11 is noted for its cement production. In King, Skagit, and Whatcom counties, cement ranked first in value of minerals produced in 1964. Four cement plants have operated for several years; one plant has recently ceased operation, but others are proposed or in the construction stage. The value of cement produced during the 15-year period 1950-65 has exceed $10 million annually except for 1957. Although much of the limestone (cement

rock) used for cement manufacture has been imported from Canada, there have also been large quantities of raw materials such as limestone, shale, and silica rock obtained from local deposits.

Coal fields with large potential reserves and formerly important production are present. Their current output is very small, but changing trends in electric power production may improve the future outlook for coal utilization.

It has the largest number of copper deposits and probably the greatest potential copper reserves in the State of Washington. The Glacier Peak deposit has indicated reserves of 30 to 50 million tons of low grade copper ore. There are several other deposits being explored currently that may be in the same size category.

The Twin Sisters District contains the largest known reserves of olivine in the Nation. The deposits cover an area 4 miles wide and 10 miles long. Production has been continuous since 1946.

The State of Washington ranked first in peat production in the Nation from 1951 to 1954 and nearly all of the output comes from this area.

The total area consists of 99 percent land and 1 percent water. Table 223 shows the land, water, and total acreages by state and counties. However, it must be understood that approximately 2,500 square miles of Puget Sound salt water are not included in the Columbia-North Pacific Study area and are, therefore, not included. Except for table 223, only areas of land will be recorded throughout the following section.

Table 223 - Areas by State and County, Subregion 11, 1967

State and County	Water Area Sq. Mi.	Water Area Acres	Land Area1/ Sq. Mi.	Land Area1/ Acres	Total Area Sq. Mi.	Total Area Acres
Washington						
Clallam	01.2	800	592.2	379,000	593.4	379,800
Grays Harbor	.0	0	01.2	800	01.2	800
Island	00.6	400	209.2	133,900	209.8	134,300
Jefferson	00.2	100	755.3	483,400	755.5	483,500
King	58.4	37,400	2,128.5	1,362,200	2,186.9	1,399,600
Kitsap	05.0	3,200	392.5	251,200	297.5	254,400
Lewis	.0	0	220.8	141,300	220.8	141,300
Mason	13.4	8,600	737.2	471,800	750.6	480,400
Pierce	13.8	8,800	1,614.9	1,033,500	1,628.7	1,042,300
San Juan	01.0	600	174.8	111,900	175.8	112,500
Skagit	09.4	6,000	1,750.0	1,120,000	1,759.4	1,126,000
Snohomish	09.5	6,100	2,093.9	1,340,100	2,103.4	1,346,200
Thurston	05.6	3,600	414.2	265.100	419.8	268.700
Whatcom	39.1	25,000	2,113.1	1,352,400	2,152.2	1,377,400
Total Washington	157.2	100,600	13,197.8	8,446,600	13,355.0	8,547,200
Total Subregion	157.2	100,600	13,197.8	8,446,600	13,355.0	8,547,200

1/ The term "land" is defined to include all water bodies under 40 acres and streams under one-eighth mile in width.
Source: U.S.D.A. Conservation Needs Inventory adjusted to the U.S. Census.

LAND

Factors of major importance to the land resource are: the ownership status, the soils, and the present use. The combination of these factors greatly influences the present and future utilization of the land resource.

Land Ownership

Subregion 11 contains over 8.5 million acres. Private ownerships make up the largest group with 4 million acres or 48 percent of the total land area. The Federal Government owns nearly 3.5 million acres or 41 percent of the total. State, county, and municipal ownerships make up the 11 percent balance.

Nearly 2.8 million acres of the public lands are national forest. Over 1 million acres are National Parks. Another 130,000 acres are defense installations and other minor Federal holdings. Nearly a million acres are owned by state, county, and municipal governments. About 34,000 acres are Indian Reservation lands.

Table 224 - Land Ownership Acreage, Subregion 11, 1965

Administering Agencies	Washington (1,000 acres)
Department of Agriculture	
Forest Service	2,235.4
Other Agriculture	-
Subtotal	2,235.4
Department of the Interior	
Bureau of Land Management	1.6
Bureau of Indian Affairs 1/	34.2
National Park Service 2/	1,083.3
Fish and Wildlife Service	.5
Bureau of Reclamation	-
Other Interior	.8
Subtotal	1,120.4
Department of Defense	122.0
Other Federal	6.1
Federal Subtotal	3,483.9
State	682.9
County	13.9
Municipal	217.4
Public Non-Federal Subtotal	914.2
Total Public	4,398.1
Total Private	4,048.5
Grand Total	8,446.6

1/ Private lands held in trust by the Federal Government.
2/ Data updated to 1969.
Source: General Services Administration Real Property Owned by the United States as of June 30, 1965, adjusted by the Land and Minerals Work Group.

Table 224, Land Ownership, and figure 46, Land Ownership Map, show this information in detail.

Soils

Figure 47, the Soil Associations Map, shows the location and relative extent of each soil association. The associations are numbered in a general relationship to the position in the landscape. Thus bottomlands and low terraces have the lowest numbers and alpine areas have the highest. The name of each association relates to the soil series representing general kinds of soil that are most extensive in the landscape. Wherever possible, established soil series are used in the name; however, where the soil series do not have classification status, the soil series name is not recorded. Generally up to 15 percent of any soil association in known areas may consist of inclusions of soils other than those identified. Such inclusions may be similar soils or they may be highly contrasting. However, in many high mountainous areas where detailed knowledge about the area is incomplete, extensive areas are included within delineations, and inclusions of other soils may exceed 15 percent.

Table 225 contains information about each soils association shown on the map. The symbol listed in the second column on the table is the same symbol shown on the soil associations map.

The table is organized to show land characteristics and the characteristics, qualities, and some interpretations of soil series representing the dominant and contrasting kinds of soil in each association. The first six columns show some general land characteristics for each soil association. The next 11 columns show characteristics (permanent soil facts) of individual key soil series that represent dominant and contrasting soils. The following four show qualities inferred from the characteristics of these soils and the last four columns show interpretations concerning agricultural use based upon the foregoing soil characteristics and qualities. All of the representative soil series listed have status in classifications. A blank space in the soil series column indicates that the soil series name has no classification status.

The "soil groups" column contains soils associations that have broad similarities in some important characteristics and is frequently identified with a position on the landscape.

The "percentage of association" column shows the extent of each soil in an association. Differences of the total soil percentage in each association from 100 percent are inclusions of other soils and land types. For example soil association 13 lists a total of 55 percent. Knowledge of this area is limited so 45 percent of the area consists of inclusions of soils that have not been defined.

AD-A036 572 PACIFIC NORTHWEST RIVER BASINS COMMISSION VANCOUVER WASH F/G 8/6
COLUMBIA-NORTH PACIFIC REGION COMPREHENSIVE FRAMEWORK STUDY OF --ETC(U)
JUN 70 C C BOWLSBY, R J COFFMAN, C R HUBBARD

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4 OF 4
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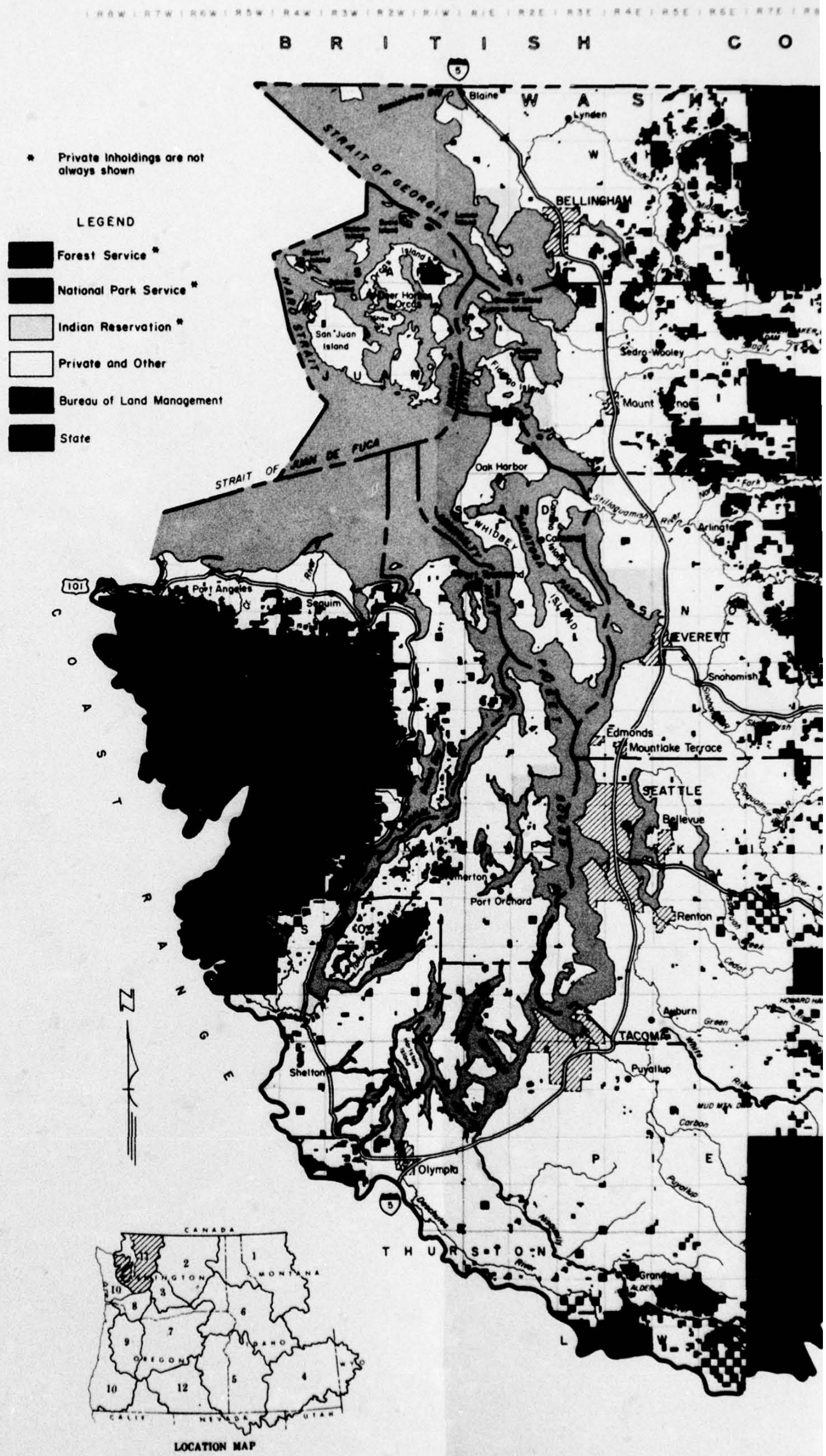
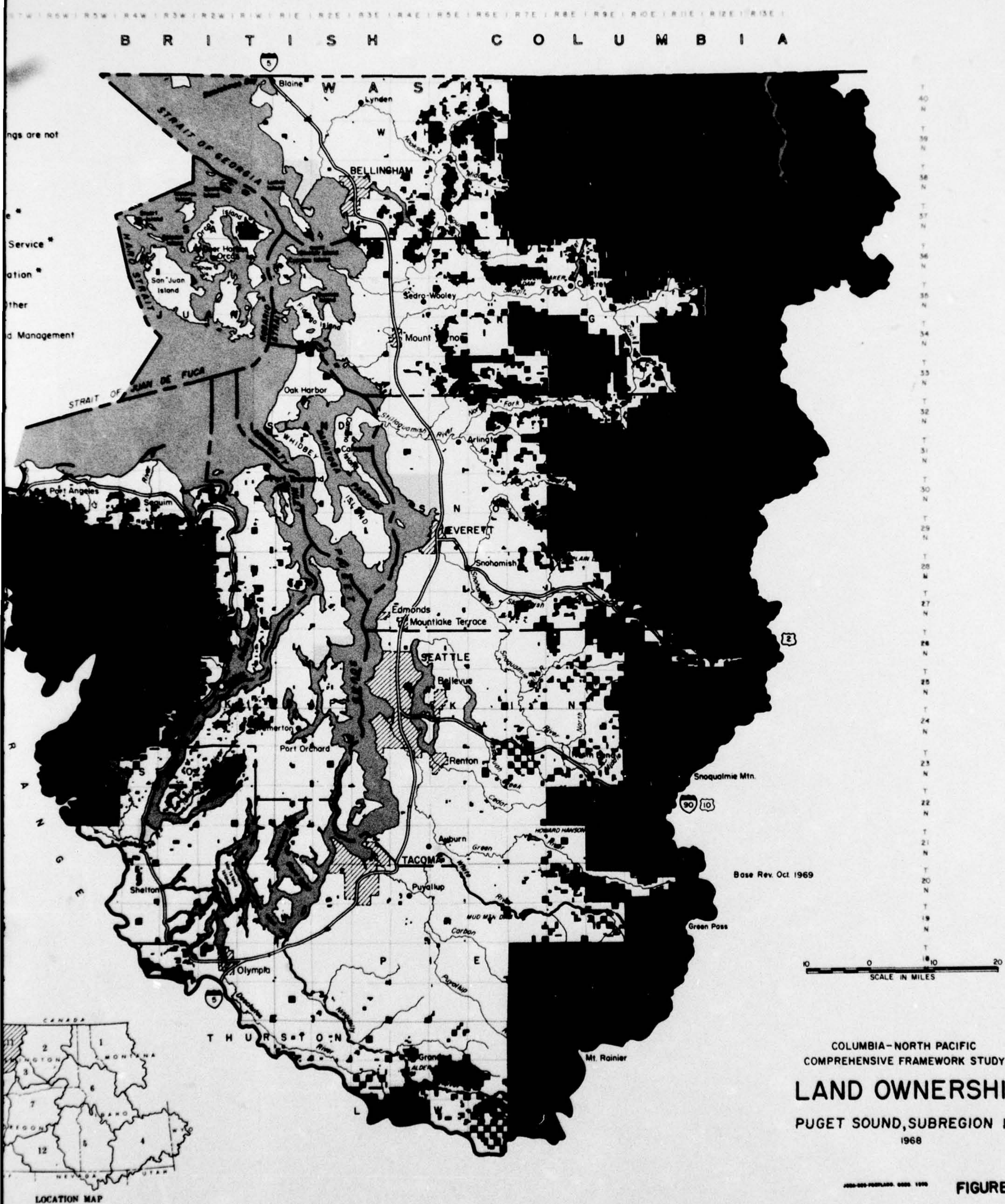

B R I T I S H C O
Private Inholdings are not always shown
LEGEND
Forest Service *
National Park Service *
Indian Reservation *
Private and Other
Bureau of Land Management
State
STRAIT OF GEORGIA
HARO STRAIT
San Juan Island
STRAIT OF JUAN DE FUCA
Blaine
Lynden
BELLINGHAM
Sedro-Woolley
Oak Harbor
WHIDBEY ISLAND
Port Angeles
Sequim
EVERETT
Snohomish
Edmonds
Mountlake Terrace
SEATTLE
Bellevue
Renton
Port Orchard
Auburn
TACOMA
Puyallup
Shelton
Olympia
C O A S T R A N G E
T H U R S T O N
CANADA
MONTANA
OREGON
LOCATION MAP



COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

LAND OWNERSHIP

PUGET SOUND, SUBREGION II
1968

FIGURE 46

2

LEGEND REVISED 1970

LEGEND

Soil Associations Map Symbol * | Name of Association

Generally silty and sandy soils formed in alluvial sediments on bottomlands and low terraces.

1 Nooksack - Puyallup
2 Lynden - Puget
3 Puyallup - Sultan
4 Puget - Puyallup

Generally silty and sandy soils with coarse fragments formed in glacial materials on terraces, plains and mountains.

5 Everett - Kapowsin
6 Whatcom - Lynden
7 Roche - Bow
8 Clallam - Elwha
9 Spanaway - Nisqually
10 Alderwood - Everett
11 Shelton - Grove
12 Dungeness - Clallam
13 Whidbey - Hoypus
14 Dominantly Cryandepts
15 Dominantly Cryandepts

Generally clayey soils formed in materials mixed with residuum-colluvium from sedimentary bedrock on foothills and uplands.

16 Dominantly Haplumbrepts
17 Pickett - Rockland
18 Dominantly Cryandepts

Generally silty soils formed in materials mixed with rocky residuum-colluvium from basic rock types on plateaus, canyons and mountains.

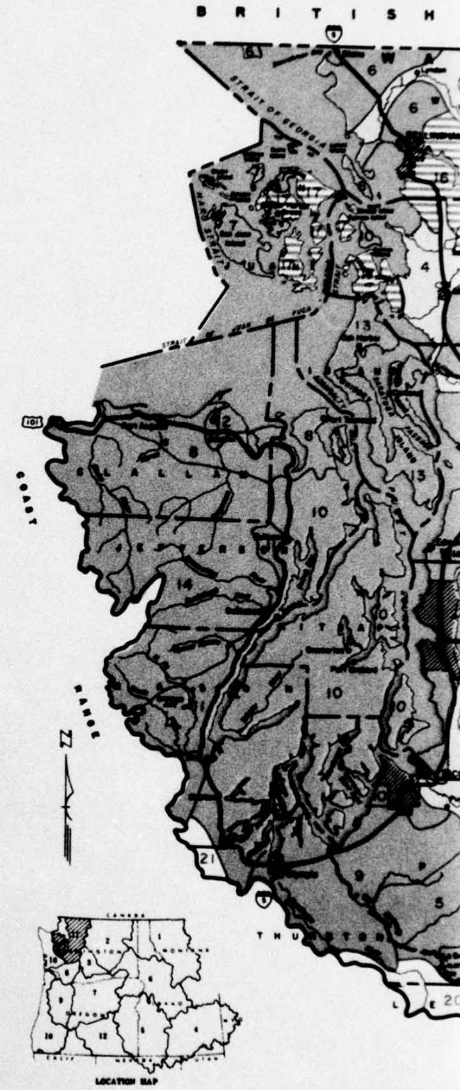
19 Rockland

Generally sandy soils formed in materials mixed with volcanic ash or pumice on terraces, foothills, plateaus and mountains.

20 Cinebar - Olympic
21 Wilkeson - Melbourne
22 Dominantly Cryandepts

** Symbols are non-conotative and consistent only within each subregion. To compare delineations from one subregion to another refer to the name of the Soil Association.*

NOTE: The Soil Association name may include a series that does not fit the Soil Associations Group description. The Soil Association name is based on dominant series. The dominant of five series may be only 30 percent of the Soil Association. Thus a clayey textured soil series may be included in a group accurately described as generally silty and sandy in texture.



ED 1970

D

Association

soils formed in alluvial
nd low terraces.

- Puyallup
Puget
- Sultan
yallup

soils with coarse fragments form-
terraces, plains and mountains.

Kapowsin
- Lynden
ow
Elwha
- Nisqually
d - Everett
Grove
- Clallam
- Hoypus
y Cryandepts
y Cryandepts

ned in materials mixed with
edimentary bedrock on foot-

y Haplumbrepts
Rockland
y Cryandepts

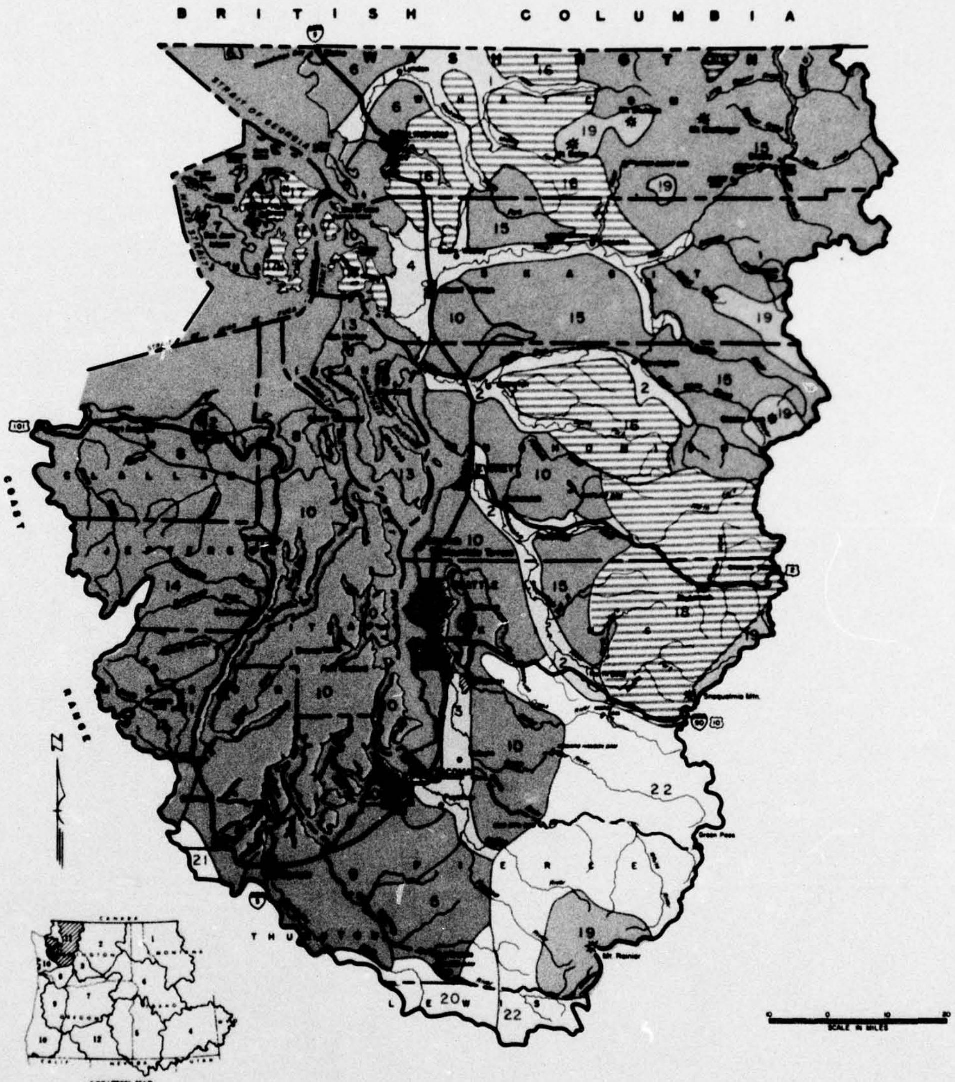
d in materials mixed with
from basic rock types on
ntains.

ed in materials mixed with
terraces, foothills, plateaus

Olympic
- Melbourne
ly Cryandepts

e and consistent only within each
ations from one subregion to
e Soil Association.

name may include a series that does
roup description. The Soil Assoc-
ant series. The dominant of five
of the Soil Association. Thus a
y be included in a group accurately
nd sandy in texture.



COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

SOIL ASSOCIATIONS

PUGET SOUND, SUBREGION 11

FIGURE 47

2

Terms listed for permeability of water through the subsoil and and permeability of substratum are:

Very rapid: Over 10 inches per hour.
Rapid: 5 to 10 inches per hour.
Moderately rapid: 2.50 to 5 inches per hour.
Moderate: 0.8 to 2.5 inches per hour.
Moderately slow: 0.2 to 0.8 inches per hour.
Slow: 0.05 to 0.2 inches per hour.
Very slow: Less than 0.05 inches per hour.

Terms listed for total available water-holding capacity are:

Low: Less than 6 inches in profile.
Medium: 6 to 10 inches.
High: More than 10 inches in profile.

The irrigated capability subclasses are an interpretation of limitations and hazards of using only presently irrigated lands. Many areas not presently irrigated may be potentially irrigable but are not included in this classification.

A dash indicates that a column does not apply or there is insufficient data to complete it.

Table 225 and 226 show the unique features and extent of soils in the subregion. Sixty percent of the soils formed in glacial materials on terraces and foothills. They are mostly deep to very deep, rocky soils with frequent lenses of fragipan that somewhat restrict use and management. Ten percent of the soils formed in alluvial sediments on bottomlands and have little or no coarse fragments in the profile. Almost 20 percent of the soils formed in residuum-colluvium from sedimentary bedrock on foothills and low mountainous uplands. Over 10 percent of the soils formed in materials mixed with volcanic ash and pumice, mostly on high mountainous uplands. However, adjacent to Mt. Adams and Mt. St. Helens volcanic ash influences the soils on foothills and terraces.

Table 226 shows the extimated acreage and proportionate extent of the soils associations in Subregion 11.

Table 226 - Soil Associations Acreage, Subregion 11, 1966

Soil Association			
Map Symbol	Name	Washington (1,000 acres)	Percent
1	Nooksack-Puyallup	140.0	1.7
2	Lynden-Puget	270.0	3.2
3	Puyallup-Sultan	130.0	1.5
4	Puget-Puyallup	200.0	2.4
5	Everett-Kapowsin	175.0	2.1
6	Whatcom-Lynden	100.0	1.2
7	Roche-Bow	80.0	.9
8	Clallam-Elwha	160.0	1.9
9	Spanaway-Nisqually	310.0	3.7
10	Alderwood-Everett	1,660.0	19.7
11	Shelton-Grove	160.0	1.9
12	Dungeness-Clallam	18.0	0.2
13	Whidbey-Haypus	140.0	1.7
14	Dominantly Cryandepts	700.0	8.3
15	Cryandepts	1,658.6	19.6
16	Dominantly Haplumbrepts	700.0	8.3
17	Pickett-Rockland	45.0	0.5
18	Dominantly Cryandepts	570.0	6.7
19	Rockland	350.0	4.1
20	Cinebar-Olympic	110.0	1.3
21	Wilkeson-Melbourne	35.0	0.4
22	Dominantly Cryandepts	735.0	8.7
Total	Land Area	8,446.6	100.0

Source: National Cooperative Soil Survey.

Interpretations and Evaluation

Table 227 relates the land capability classes to the Land Capability Map, figure 3. It must be realized that the Land Capability Map is highly generalized and a specific capability class on table 227 may not be shown. To determine the land capability of any particular area refer to the soil association symbols listed in the second column of the table and then locate that symbol on the Soil Associations Map, figure 47. Table 227 also shows the acreage and extent of the dominant land capability class for practical segments of the landscape.

Classified on Table 228 is the dominant water storage capacity for each soil association in Subregion 11. Each class on the table relates to a similar class on the Water Storage Capacity, figure 4. To locate those areas having contrasing water storage capacity in the upper 5 feet of soil, refer to figure 4, to figure 47 (the subregional Soil Associations Map), and to table 228. The class letter symbol in the first column and the Soil Associations Map numerical symbol listed in the second column may be used to locate those areas having contrasting water storage capacity. Complete utilization of this storage contributes toward more stable and sustained streamflow.

Table 225 - Characteristics and Qualities of Representative Soils, Subregion 1[illegible]

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage of Assn. 3/	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth
Very deep soils with loamy and sandy subsoils on nearly level slopes.	1	0-300	50-60	200	Cropland (hay, cereals, and pasture) - 4% irrigated	Aquic Xerofluvents	Coarse-silty, mixed, mesic, nonacid	Nooksack	30	Terraces	Alluvium	Silt loam	Silt loam	None	--	40-60" over clayey material
					Forest land 4/	Fluventic Haploxerolls	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Puyallup	30	Flood plains	Alluvium	Fine sandy loam or silt loam	Sandy loam to loamy very fine sand	None	--	60"+
						Typic Xeropsamments	Mixed, mesic	Lynden	10	Terraces	Sand	Sandy loam	Sand or loamy sand	None	--	60"+ over sand
						--	--	Semiahmoo	3	Basins	Organic material	Muck or peat	Peat	None	--	60"+
	2	0-500	35-100	150-200	Cropland (hay, cereals, and pasture) - 2% irrigated	Typic Xeropsamments	Mixed, mesic	Lynden	25	Terraces	Sand	Sandy loam	Sand or loamy sand	None	--	60"+ over sand
					Forest land 4/	Fluventic Haplaquepts	Fine-silty, mixed, nonacid, mesic	Puget	20	Flood plains	Alluvium	Silt loam	Silty clay loam	None	--	60"+ over clayey material
						Typic Xeropsamments	Mixed, mesic	Pilchuck	15	Flood plains	Alluvium	Sandy loam	Loamy sand	None	--	60"+ over sand
						Fluventic Haploxerolls	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Puyallup	10	Flood plains	Alluvium	Sandy loam	Sandy loam	None	--	60"+ over sand
						Thapto-Histic Haplaquepts	Fine, mixed, nonacid, mesic	Snohomish	10	Flood plains	Alluvium	Silt loam	Loam (organic material below 20-40")	None	--	60"

Table 225 - Characteristics and Qualities of Representative Soils, Subregion 11[1/]

Percentage[3/] of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass Dryland	Range of: Major Capability Subclass Irrigated[6/]	Major Soil Problems	Suitable Land Treatment and Structures
30	Terraces	Alluvium	Silt loam	Silt loam	None	--	40-60" over clayey material	Moderate	Slow	Somewhat poor	High	IIs IIw	IIs IIw	Wetness	Drainage; irrigation mgmt; forest land management
30	Flood plains	Alluvium	Fine sandy loam or silt loam	Sandy loam to loamy very fine sand	None	--	60"+	Rapid	Rapid	Somewhat poor	Medium	IIw,IIIe IIIw,IIIs IVw,IVs	IIw IIIe IIIw IIIs	Wetness; flooding; sandy profile	Drainage;flood protection; irrigation mgmt; pastureland mgmt; forest land management
10	Terraces	Sand	Sandy loam	Sand or loamy sand	None	--	60"+ over sand	Very rapid	Very rapid	Good to excessive	Low	IIIe IIIs IVe,VIs	IIIe IIIs	Sandy profile	Pastureland mgmt; forest land mgmt;irrigation mgmt.
3	Basins	Organic material	Muck or peat	Peat	None	--	60"+	Moderate	Moderate	Poor	High	IIw IVw	IIw	Wetness; organic profile; acid soil	Drainage; soil amendments; irrigation mgmt; pastureland management
25	Terraces	Sand	Sandy loam	Sand or loamy sand	None	--	60"+ over sand	Very rapid	Very rapid	Good to excessive	Low	IIIe,IIIs IVe IVs	IIIe IIIs	Sandy profile	Pastureland mgmt; forest land mgmt; irrigation management
20	Flood plains	Alluvium	Silt loam	Silty clay loam	None	--	60"+ over clayey material	Moderate	Slow	Moderately good and somewhat poor	High	IIw IIIw	IIw IIIw	Wetness	Drainage; irrigation mgmt; forest land management
15	Flood plains	Alluvium	Sandy loam	Loamy sand	None	--	60"+ over sand	Very rapid	Very rapid	Somewhat excessive	Medium	VIs	--	Flooding; sandy profile	Flood protection;pastureland mgmt; forest land management
10	Flood plains	Alluvium	Sandy loam	Sandy loam	None	--	60"+ over sand	Rapid	Very rapid	Moderately good	Medium	IIs IIIs	IIs IIIs	Flooding; sandy profile	Flood protection; irrig. mgmt; pastureland mgmt; forest land mgmt.
10	Flood plains	Alluvium	Silt loam	Loam (organic material below 20-40")	None	--	60"	Moderate	Moderate	Moderately good and somewhat poor	High	IIw	IIw	Wetness	Drainage; irrigation mgmt; forest land mgmt.

2

Table 225 - Continued

Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series 2/	Percentage 3/ of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth	Perme... Su...
	3	100-300	35-45	130-180	Cropland (hay, pasture and some truck crops) - 10% irrigated	Fluventic Haploxerolls	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Puyallup	40	Flood plains	Alluvium	Sandy loam	Sandy loam	None	--	60"+ over sand	Rapid
					Forest land	Typic Xerochrepts	Fine-silty, mixed, mesic	Sultan	25	Flood plains	Alluvium	Silt loam	Loam	None	--	60"+ over sand & silt	Moder...
						Typic Xeropsamments	Mixed, mesic	Pilchuck	10	Flood plains	Alluvium	Sandy loam	Loamy sand	None	--	60"+ over sand	Very ...
						Fluventic Haplaquepts	Fine-silty, mixed, nonacid, mesic	Puget	10	Flood plains	Alluvium	Silt loam	Silty clay loam	None	--	60"+ over clayey material	Moder...
	4	0-500	45-70	150-200	Cropland (hay, cereals, and pasture) - 2% irrigated	Fluventic Haplaquepts	Fine-silty, mixed, nonacid, mesic	Puget	30	Flood plains	Alluvium	Silt loam	Silty clay loam	None	--	60"+ over clayey material	Moder...
					Forest land	Fluventic Haploxerolls	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Puyallup	20	Flood plains	Alluvium	Silt loam	Sandy loam to loamy very fine sand	None	--	60"+ over sand	Rapid
						Typic Xeropsamments	Mixed, mesic	Lynden	10	Terraces	Sand	Sandy loam	Sand or loamy sand	None	--	60"+ over sand	Very ...
						Typic Xeropsamments	Mixed, mesic	Pilchuck	10	Flood plains	Alluvium	Sandy loam	Loamy sand	None	--	60"+ over sand	Very ...
						Typic Haplorthods	Loamy-skeletal, mixed, mesic	Everett	10	Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile; 60 below 20-36"	20-36" over gravel and sand	Rapid
						Spodic Udipsamments	Mixed, mesic	Greenwater	5	Terraces (dissected)	Alluvium	Fine sand	Loamy sand and/or sand	None	--	60"+	Moderately rapid

Table 225 - Continued

Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass 6/: Dryland	Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
Flood plains	Alluvium	Sandy loam	Sandy loam	None	--	60"+ over sand	Rapid	Very rapid	Moderately good	Medium	IIs IIIs	IIs IIIs	Flooding; sandy profile	Flood protection; irrigation mgmt; pastureland mgmt; forest land mgmt.
Flood plains	Alluvium	Silt loam	Loam	None	--	60"+ over sand & silt	Moderate	Moderate	Good	High	I IIs	I IIs	Maintaining soil tilth	Irrigation mgmt; residue mgmt; forest land mgmt.
Flood plains	Alluvium	Sandy loam	Loamy sand	None	--	60"+ over sand	Very rapid	Very rapid	Somewhat excessive	Medium	VIs	--	Flooding; sandy profile	Flood protection; pastureland mgmt; forest land management
Flood plains	Alluvium	Silt loam	Silty clay loam	None	--	60"+ over clayey material	Moderate	Slow	Poor	High	IIw IIIw	IIw IIIw	Wetness	Drainage; irrigation management
Flood plains	Alluvium	Silt loam	Silty clay loam	None	--	60"+ over clayey material	Moderate	Slow	Poor	High	IIw IIIw	IIw IIIw	Wetness	Drainage; irrigation management
Flood plains	Alluvium	Silt loam	Sandy loam to loamy very fine sand	None	--	60"+ over sand	Rapid	Rapid	Somewhat poor	Medium	IIIw IIIs IVw	IIIw IIIs IVw	Wetness; flooding; sandy profile	Drainage; flood protection, irrig.mgmt; pastureland mgmt; forest land mgmt.
Terraces	Sand	Sandy loam	Sand or loamy sand	None	--	60"+ over sand	Very rapid	Very rapid	Good to excessive	Low	IIIe IIIs IVe,IVs	IIIe IIIs	Sandy profile	Pastureland mgmt; forest land mgmt; irrigation management
Flood plains	Alluvium	Sandy loam	Loamy sand	None	--	60"+ over sand	Very rapid	Very rapid	Somewhat excessive	Medium	VIs	--	Flooding; sandy profile	Flood protection;pastureland mgmt;forest land mgmt
Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile; 60 below 20-36"	20-36" over gravel and sand	Rapid	Very rapid	Somewhat excessive	Low	VIe	--	Erosion;moderately deep over gravel & sand;gravelly profile	Pastureland mgmt; forest land management
Terraces (dissected)	Alluvium	Fine sand	Loamy sand and/or sand	None	--	60"+	Moderately rapid	Very rapid	Somewhat excessive	Low	VIs	--	Sandy profile	Forest land mgmt;pastureland management

2

Table 225 - Continued

Soil Groups	Map Sym.	Soil Association: Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth	Perme[...] Su[...]
Moderately deep to very deep soils with drainage restrictions and loamy to clayey and gravelly subsoils on nearly level to moderate slopes.	5	100-5,500	30-65	50-170	Forest land[4/]	Typic Haplorthods	Loamy-skeletal, mixed, mesic	Everett	40	Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile; 60 below 20-36"	20-36" over gravel and sand	Rapid
					Cropland (pasture and silage)-30% irrigated	Typic Haplaquepts	Coarse-loamy, mixed, nonacid, mesic	Kapowsin	30	Upland-glacial	Glacial till	Gravelly sandy loam	Gravelly loam	Gravel	20-35 in profile	38" over compacted till	Moder
						Andic Glossoboric Hapludalfs	Fine, mixed, mesic	Wilkeson	20	Uplands (footslopes and side slopes)	Volcanic ash and basic igneous rock	Silty clay loam	Clay loam to clay	None	--	36-60"+ over bedrock	Very
						Spodic Udipsamments	Mixed, mesic	Greenwater	5	Terraces (dissected)	Alluvium	Fine sand	Loamy sand and/or sand	None	--	60"+	Modera rapid
	6	0-500	45-50	180-200	Cropland (hay, cereals, and pasture)-95% dryland	Duric Haplorthods	Coarse-silty, mixed, mesic	Whatcom	25	Terraces	Alluvium	Silt loam	Silt loam	None	--	24-36" over compact silts and clays	Modera
					Forest land	Typic Xeropsamments	Mixed, mesic	Lynden	20	Terraces	Sand	Sandy loam	Sand or loamy sand	None	--	60"+	Very r
						Aquic Xeropsamments	Mixed, mesic	Cagey	15	Terraces	Till	Silt loam	Gravelly loamy very fine sand	Gravel	20-35 below 10" in profile	36-60"+ over clayey material	Moderat
						Aeric Glossaqualfs	Fine, mixed, mesic	Bow	10	Terraces	Till or marine sediments	Silt loam	Clay loam	None	--	20" over compact till or marine sediments	Moderat
						Aquic Dystrochrepts	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Norma	10	Basins in uplands	Alluvium	Loam	Sand and silts (stratified)	None	--	48"+ over clay	Moderat
						Typic Argiaquolls	Fine, mixed, non-calcareous, mesic	Bellingham	5	Basins in floodplains	Alluvium	Clay loam	Clay loam or clay	None	--	20" over clayey material	Moderat moderat slow

Table 225 - Continued

Percentage[5] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass[6]: Dryland	Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
40	Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile; 60 below 20-36"	20-36" over gravel and sand	Rapid	Very rapid	Somewhat excessive	Low	VIs VIIe	--	Erosion; moderately deep over gravel & sand;gravelly profile	Forest land management; pastureland management
30	Upland-glacial	Glacial till	Gravelly sandy loam	Gravelly loam	Gravel	20-35 in profile	38" over compacted till	Moderate	Very slow	Somewhat poor	Low	IIIw VIe	IIIw	Droughtiness	Pastureland mgmt; irrigation mgmt.
20	Uplands (footslopes and side slopes)	Volcanic ash and basic igneous rock	Silty clay loam	Clay loam to clay	None	--	36-60"+ over bedrock	Very slow	Impervious	Good	Medium and high	VIe VIIe	--	Erosion; clayey subsoil; acid soil	Forest lard management
5	Terraces (dissected)	Alluvium	Fine sand	Loamy sand and/or sand	None	--	60"+	Moderately rapid	Very rapid	Somewhat excessive	Low	VIs	--	Sandy profile	Forest land management; pastureland management
25	Terraces	Alluvium	Silt loam	Silt loam	None	--	24-36" over compact silts and clays	Moderate	Slow	Somewhat poor	High	IIIw IVe VIe	IIIw IVe	Erosion; high water table;moderately deep over compacted silts and clays	Drainage; pastureland mgmt; irrigation mgmt; forest land mgmt.
20	Terraces	Sand	Sandy loam	Sand or loamy sand	None	--	60"+	Very rapid	Very rapid	Good to excessive	Low	IIIs IVs	--	Sandy profile	Pastureland mgmt; forest land mgmt.
15	Terraces	Till	Silt loam	Gravelly loamy very fine sand	Gravel	20-35 below 10" in profile	36-60"+ over clayey material	Moderate	Slow	Poor	Medium	IIIw IVe	--	Erosion; high water table; gravelly subsoil	Drainage; pastureland management
10	Terraces	Till or marine sediments	Silt loam	Clay loam	None	--	20" over compact till or marine sediments	Moderate	Slow	Moderately good	Medium	IIIs IVe	IIIs IVe	Erosion; 20" over compacted till or marine sediments	Pastureland mgmt; irrigation mgmt; forest land management
10	Basins in uplands	Alluvium	Loam	Sand and silts (stratified)	None	--	48"+ over clay	Moderate	Slow	Poor	Medium	IIIw	--	High water table	Drainage; pastureland management
5	Basins in floodplains	Alluvium	Clay loam	Clay loam or clay	None	--	20" over clayey material	Moderate & moderately slow	Slow	Poor	High	IIIw IVw	--	High water table; clayey profile	Drainage; pastureland management

2

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage of Assn. 3/	Position on Landscape	Parent Material	Soil Characteristics: Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth
	7	0-300	25-35	180-200	Forest land Cropland (hay and pasture)-10% irrigated	Aqualfic Haplorthods	Coarse-loamy, mixed, mesic	Roche	50	Uplands (plains)	Glacial till	Gravelly loam	Fine sandy loam	Gravel	20-35 in top 10"	40" over compa fine sandy loam
						Aeric Glossaqualfs	Fine, mixed, mesic	Bow	20	Terraces	Till or marine sediments	Silt loam	Clay loam	None	--	20" over compact till or marine sedimen
						Xeric Argialbolls	Fine-loamy, mixed, mesic	Coveland	10	Uplands - glacial	Glacial drift	Loam	Clay	None	--	40" over compacted til
						Typic Xeropsamments	Mixed, mesic	Indianola	5	Terraces	Glacial material	Loamy sand	Loamy sand or sand	None	--	60"+ over sand
						Typic Argiaquolls	Fine, mixed, noncalcareous, mesic	Bellingham	3	Basins in uplands	Alluvium	Silt loam or silty clay loam	Silty clay loam or silty clay	None	--	20" over clayey material
Moderately deep to very deep soils with sandy to loamy, gravelly subsoils on gentle to strong slopes.	8	0-3,000	13-35	100-180	Forest land 4/ Cropland (pasture, silage and hay) - 50% irrigated	Dystric Xerochrepts	Coarse-loamy, mixed, mesic	Clallam	25	Uplands (plains)	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	40"+ over compact cobbly till
						Dystric Xerochrepts	Fine-loamy, mixed, mesic	Elwha	20	Uplands (plains and footslopes)	Glacial till	Loam	Gravelly sandy loam	Gravel	20-35 below 10" in profile	60"+
						Duric Haplorthods	Loamy-skeletal, mixed, mesic	Alderwood	10	Terraces	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	20-40" over cemented till
						Typic Haplorthods	Loamy-skeletal, mixed, mesic	Everett	10	Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile; 60 below 20-36"	20-36" over gravel and sand
						Typic Xeropsamments	Mixed, mesic	Keystone	10	Terraces	Glacial outwash	Loamy sand	Loamy sand to sand	None	--	20-40" over sand

Table 225 - Continued

Position on Landscape	Soil Characteristics							Soil Qualities and Interpretations						
	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass Dryland	Range of: Major Capability Subclass Irrigated[6/]	Major Soil Problems	Suitable Land Treatment and Structures
Uplands (plains)	Glacial till	Gravelly loam	Fine sandy loam	Gravel	20-35 in top 10"	40" over compact fine sandy loam	Moderately rapid	Moderately slow and slow	Moderately good	Medium	IIIs IVe IVs,VIs	IIIs IVe IVs	Erosion; gravelly surface soil	Forest land mgmt;pastureland mgmt; irrigation management
Terraces	Till or marine sediments	Silt loam	Clay loam	None	--	20" over compact till or marine sediments	Moderate	Slow	Moderately good	Medium	IIIs IVe	IIIs IVe	Erosion; 20" over compacted till or marine sediments	Forest land mgmt;pastureland mgmt; irrigation management
Uplands - glacial	Glacial drift	Loam	Clay	None	--	40" over compacted till	Slow	Very slow	Somewhat poor	Low	IIIw IIIe	IIIw	Droughtiness	Forest land mgmt; irrigation management
Terraces	Glacial material	Loamy sand	Loamy sand or sand	None	--	60"+ over sand	Very rapid	Very rapid	Good	Low	IVe IVs	--	Erosion; sandy profile	Forest land mgmt; pastureland management
Basins in uplands	Alluvium	Silt loam or silty clay loam	Silty clay loam or silty clay	None	--	20" over clayey material	Moderate and moderately slow	Slow	Poor	High	IIIw	--	High water table; clayey profile	Drainage; pastureland management
Uplands (plains)	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	40"+ over compact cobbly till	Rapid	Very slow	Good	Low	IVs VIs	IVs	Gravelly profile; acid soil	Forest land mgmt; pastureland mgmt; irrigation mgmt; soil amendments
Uplands (plains and footslopes)	Glacial till	Loam	Gravelly sandy loam	Gravel	20-35 below 10" in profile	60"+	Rapid	Rapid	Moderately good	Medium	VIs	--	Gravelly profile; below 10"; acid soil	Forest land management
Terraces	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	20-40" over cemented till	Rapid	Very slow	Good and moderately good	Low	IVs,VIe VIs VIIe	IVs	Erosion; moderately deep over cemented till;gravelly profile	Forest land mgmt; irrigation mgmt; pastureland mgmt.
Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile; 60 below 20-36"	20-36" over gravel and sand	Rapid	Very rapid	Somewhat excessive	Low	VIs VIIe	--	Erosion; moderately deep over gravel & sand;gravelly profile	Forest land mgmt;pastureland managerent
Terraces	Glacial outwash	Loamy sand	Loamy sand to sand	None	--	20-40" over sand	Very rapid	Very rapid	Somewhat excessive	Low	VIe VIs	--	Erosion; sandy profile	Forest land mgmt; pastureland management

2

Table 225 - Continued

Soil Association						Classification			Per-cent-age[3] of Assn.	Position on Landscape	Soil Characteristics					
Soil Groups	Map Sym.	Eleva-tion Feet	Precip. Inches	Freeze free Season	Major land use	Great Group or Subgroup	Family	Series[2]			Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth
	9	0-750	35-40	150-180	Forest land[4] Rangeland	Typic Xerumbrepts	Sandy-skeletal, mixed, mesic	Spanaway	35	Terrace (outwash plain)	Glacial outwash	Gravelly loam	Gravelly sandy loam	Gravel and cobbles	20-35 in profile; 60 below 20-40"	20-40" over outwash grave & cobbles
					Cropland (berries, cereals, pasture and silage)-50% irrigated	Pachic Xerumbrepts	Sandy, mixed, mesic	Nisqually	15	Glacial uplands	Glacial outwash	Loamy sand	Sand	None	--	60"+
						Duric Haplorthods	Loamy-skeletal, mixed, mesic	Alderwood	15	Terraces	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	20-40" over cemented till
						Typic Haplorthods	Loamy-skeletal, mixed, mesic	Everett	10	Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile;60 below 20-36"	20-36" over gravel and sand
						Typic Xeropsamments	Mixed, mesic	Tumwater	10	Glacial terrace	Glacial outwash	Loamy fine sand	Loamy fine sand	None	--	50" over gravel
						Typic Xerorthents	Sandy-skeletal, mixed, mesic	Fitch	8	Uplands (plains)	Glacial outwash	Gravelly sandy loam	Gravelly loamy sand or sand	Gravel and sand	20-35 in profile;60 below 60"+	60"+ over sand and gravel
	10	0-1,000	20-60	140-200	Forest land[4] Cropland (hay, pasture and silage) - 5% irrigated	Duric Haplorthods	Loamy-skeletal, mixed, mesic	Alderwood	40	Uplands (undulating to rolling plains)	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	20-40" over cemented till
						Typic Haplorthods	Loamy-skeletal, mixed, mesic	Everett	30	Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile;60 below 20-36"	20-36" over gravel and sand
						Aquic Dystrochrepts	Fine-loamy, mixed, mesic	Cloquallum	10	Terraces (nearly level to hilly)	Lake sediments	Silt loam	Silt loam	None	--	60"+ over clayey lake sediments
						Typic Xeropsamments	Mixed, mesic	Indianola	5	Terraces	Glacial material	Loamy sand	Loamy sand or sand	None	--	60"+ over sand

Table 225 - Continued

Percentage[5] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated[6]	Major Soil Problems	Suitable Land Treatment and Structures
35	Terrace (outwash plain)	Glacial outwash	Gravelly loam	Gravelly sandy loam	Gravel and cobbles	20-35 in profile; 60 below 20-40"	20-40" over outwash gravel & cobbles	Very rapid	Very rapid	Excessive	Low to medium	VIs	--	Gravelly & cobbly profile & substrats	Forest land mgmt; pastureland management
15	Glacial uplands	Glacial outwash	Loamy sand	Sand	None	--	60"+	Very rapid	Very rapid	Excessive	Low to medium	IVs VIs	IIIe IVs	Droughtiness	Pastureland mgmt; irrigation mgmt.
15	Terraces	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	20-40" over cemented till	Rapid	Very slow	Good and moderately good	Low to medium	IVs,VIe VIs VIIe	IVs	Erosion; moderately deep over cemented till;gravelly profile	Forest land mgmt; pastureland mgmt; irrigation mgmt
10	Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile;60 below 20-36"	20-36" over gravel and sand	Rapid	Very rapid	Somewhat excessive	Low to medium	VIs VIIe	--	Erosion; moderately deep over gravel & sand;gravelly profile	Forest land mgmt; pastureland mgmt.
10	Glacial terrace	Glacial outwash	Loamy fine sand	Loamy fine sand	None	--	50" over gravel	Rapid	Very rapid	Well to excessive	Low to medium	IVs VIs	IIIs IVs	Droughtiness	Forest land mgmt; irrigation mgmt.
8	Uplands (plains)	Glacial outwash	Gravelly sandy loam	Gravelly loamy sand or sand	Gravel and sand	20-35 in profile;60 below 60"+	60"+ over sand and gravel	Very rapid	Very rapid	Somewhat excessive	Low to medium	VIs	--	Gravelly and sandy profile	Forest land mgmt; pastureland mgmt.
40	Uplands (undulating to rolling plains)	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	20-40" over cemented till	Rapid	Very slow	Good and moderately good	Low to medium	IVs,VIe VIs VIIe	--	Erosion; moderately deep over cemented till;gravelly profile	Forest land mgmt; pastureland mgmt.
30	Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile;60 below 20-36"	20-36" over gravel and sand	Rapid	Very rapid	Somewhat excessive	Low to medium	VIs VIIe	--	Erosion; moderately deep over gravel & sand;gravelly profile	Pastureland mgmt; forest land mgmt.
10	Terraces (nearly level to hilly)	Lake sediments	Silt loam	Silt loam	None	--	60"+ over clayey lake sediments	Moderate	Slow	Moderately good	High	IIIs IVe VIe	IIIs IVe	Erosion	Forest land mgmt; irrigation mgmt; pastureland management
5	Terraces	Glacial material	Loamy sand	Loamy sand or sand	None	--	60"+ over sand	Very rapid	Very rapid	Good	Low	IVe IVs	--	Erosion; sandy profile	Forest land mgmt; pastureland management

2

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth	Perme… Su…
	11	600-4,000	50-100	50-120	Forest land[4]	Duric Haplorthods	Coarse-loamy, mixed, mesic	Shelton	40	Uplands	Glacial till	Gravelly sandy loam	Very gravelly sandy loam	Gravel	20-35 in profile	30-36" over cemented till	Rapid
						Typic Haplorthods	Sandy-skeletal, mixed, mesic	Grove	30	Uplands (plains)	Glacial outwash	Gravelly sandy loam	Gravelly loam or gravelly sandy loam	Gravel and sand	20-35 in profile;60 below 30-60"+	30-60"+ over gravel and sand	Moder… rapid
						Duric Haplorthods	Loamy-skeletal, mixed, mesic	Hoodsport	20	Uplands	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	23-30" over cemented till	Rapid
	12	0-200	13-25	180-200	Forest land Cropland (hay, pasture and silage) - 50% irrigated	Typic Xerochrepts	Fine-silty, mixed, mesic	Dungeness	30	Alluvial stream terrace	Alluvium	Fine sandy loam	Gravelly loam	Gravel	20-35 below 12"	60"+	Moder…
						Typic Xerumbrepts	Sandy, skeletal, mixed, mesic		25	Low glacial terraces	Glacial fluvial	Cobbly loam	Very cobbly loamy sand	Gravel and cobble	20-35 to 12"; 35-60 to 40"; 35" below 40"	40" over gravel	Rapid
					Rangeland	Dystric Xerochrepts	Loamy-skeletal, mixed, mesic	Clallam	25	Uplands (plains)	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	40"+ over compact cobbly till	Rapid
						Typic Haplorthods	Sandy-skeletal, mixed, mesic	Carlsborg	10	Fans	Alluvium	Gravelly loam	Gravelly sandy loam	Gravel	20-35 in profile	60"+	Rapid
	13	0-400	18-25	200	Forest land Cropland (hay, cereals, pasture and cane fruits)-1% irrigated	Duric Haplorthods	Loamy-skeletal, mixed, mesic	Whidbey	35	Uplands	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	60"+ over cemented till	Rapid
						Typic Xerorthents	Sandy-skeletal, mixed, mesic	Hoypus	10	Uplands (moraines & plains)	Glacial outwash	Gravelly loamy sand	Gravelly loamy sand	Gravel	20-35 in profile	60"+	Very r…
						Duric Haplorthods	Loamy-skeletal, mixed, mesic	Alderwood	10	Uplands (moraines)	Glacial till	Gravelly sandy laom	Gravelly sandy loam	Gravel	20-35 in profile	20-40" over cemented till	Rapid

Table 225 - Continued

Percentage[1] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass[6]: Dryland	Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
40	Uplands	Glacial till	Gravelly sandy loam	Very gravelly sandy loam	Gravel	20-35 in profile	30-36" over cemented till	Rapid	Slow	Good	Low to medium	VIe VIIe	--	Erosion; moderately deep over cemented till; gravelly profile; acid soil	Forest land mgmt.
30	Uplands (plains)	Glacial outwash	Gravelly sandy loam	Gravelly loam or gravelly sandy loam	Gravel and sand	20-35 in profile; 60 below 30-60"+	30-60"+ over gravel and sand	Moderate to rapid	Very rapid	Good	Low and medium	VIe VIs	--	Erosion; moderately deep over gravel & sand in places; gravelly profile; acid soil	Forest land mgmt.
20	Uplands	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	23-30" over cemented till	Rapid	Slow to cemented layer	Moderately good	Low	VIe VIs	--	Erosion; moderately deep over cemented till; gravelly profile; acid soil	Forest land mgmt.
30	Alluvial stream terrace	Alluvium	Fine sandy loam	Gravelly loam	Gravel	20-35 below 12"	60"+	Moderate	Moderate	Somewhat poor	Medium	IIIw	IIIw	High water table; droughtiness	Residue mgmt; cross-slope operations; cropping sequence; irrigation mgmt.
25	Low glacial terraces	Glacial fluvial	Cobbly loam	Very cobbly loamy sand	Gravel and cobble	20-35 to 12"; 35-60 to 40"; 35" below 40"	40" over gravel	Rapid	Very rapid	Somewhat excessive	Low	IIIw	IIIw	Droughtiness	Residue mgmt; cropping sequence; cross-slope opers; pastureland mgmt; forest land mgmt; irrigation mgmt
25	Uplands (plains)	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	40"+ over compact cobbly till	Rapid	Very slow	Good	Low	IVs VIs	IVs	Gravelly profile; acid soil	Forest land mgmt; pastureland mgmt; irrigation mgmt; soil amendments
10	Fans	Alluvium	Gravelly loam	Gravelly sandy loam	Gravel	20-35 in profile	60"+	Rapid	Rapid	Good	Medium	IVs	IVs	Gravelly profile	Forest land mgmt; pastureland mgmt; irrigation management
35	Uplands	Glacial till	Gravelly sandy loam	Gravelly sandy loam	Gravel	20-35 in profile	60"+ over cemented till	Rapid	Very slow	Good	Low to medium	IVs	--	Gravelly profile	Forest land mgmt; pastureland management
10	Uplands (moraines & plains)	Glacial outwash	Gravelly loamy sand	Gravelly loamy sand	Gravel	20-35 in profile	60"+	Very rapid	Very rapid	Excessive	Low to medium	VIs	--	Gravelly and sandy profile	Forest land management
10	Uplands (moraines)	Glacial till	Gravelly sandy laom	Gravelly sandy loam	Gravel	20-35 in profile	20-40" over cemented till	Rapid	Very slow	Good and moderately good	Low to medium	IVe IVs VIe VIs	--	Erosion; moderately deep over cemented till; gravelly profile	Forest land mgmt; pastureland management

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Table 225 - Continued

	Soil Association					Classification					Soil Characteristics			Coarse Fragments			
Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series 2/	Percentage 3/ of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Kind	Percent	Profile Depth	Perme Su
Shallow, rocky miscellaneous land to very deep soils with gravelly, loamy subsoils on moderate to very steep slopes.	14	2,000-6,500	80-120	60-120	Forest land 4/	Cryandepts plus Cryumbrepts, Cryorthods and Haplumbrepts	Ashy and fine-loamy, mixed	--	100	Uplands (slopes & mountains)	Glacial till and sedimentary and basic igneous rock	--	--	--	--	0-10" over bedrock to 60"+	Moder
	15	2,000-3,000	60-100	100-120	Forest land 4/	Cryandepts plus Cryumbrepts, Cryorthods and Haplumbrepts	Ashy and fine-loamy and coarse-loamy, mixed	--	100	Uplands (steep mountains)	Glacial material & igneous and sedimentary rock	--	--	--	--	10-60" over glacial drift or bedrock	Moder
Moderately deep to deep soils with loamy subsoils on strong to steep slopes.	16	500-2,000	70-120	100-120	Forest land 4/	Haplumbrepts plus Haplorthods, Humaquepts, Haplaquepts and Histosols	Fine-loamy and loamy-skeletal, mixed, mesic	--	100	Upland (hilly)	Sedimentary rock (sandstone) and glacial material	--	--	--	--	20-60" over glacial drift or bedrock	Moder to ra
Shallow, rocky miscellaneous land with soils having loamy profiles on strong to extremely steep slopes.	17	0-3,500	25-35	100-180	Forest land	Alfic Haplorthods	Fine-loamy, mixed, mesic	Pickett	60	Mountain tops and ridges	Sedimentary and basic igneous rock	Rocky silt loam	Stony loam or silt loam	Stones, cobbles & stones	20-35 in profile	0-40" over bedrock	Moder in Pi soil
						--	--	Rockland 5/	40	Uplands (steep mountains)	Igneous & sedimentary rock	--	--	--	--	0-10" over bedrock	--
	18	2,000-3,000	60-90	100-110	Forest land 4/	Cryandepts plus Cryumbrepts, Cryorthods, and Haplumbrepts	Ashy and coarse-loamy, mixed, mesic	--	100	Uplands (steep mountains)	Igneous & sedimentary rock	--	--	--	--	10-40" over bedrock	Moder

Table 225 - Continued

ition on ndscape	Parent Material	Soil Characteristics: Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
lands lopes & untains)	Glacial till and sedimentary and basic igneous rock	--	--	--	--	0-10" over bedrock to 60"+	Moderate	--	Moderately good	Low	VIs VIe	--	Erosion with improper land use	Continued forest land mgmt and wildland protection
lands steep untains)	Glacial material & igneous and sedimentary rock	--	--	--	--	10-60" over glacial drift or bedrock	Moderate	--	Good	Low	VIe	--	Erosion with major cover disturbances	Continued forest land mgmt; limit wet weather logging
pland hilly)	Sedimentary rock (sandstone) and glacial material	--	--	--	--	20-60" over glacial drift or bedrock	Moderate to rapid	--	Good	Low to medium	VIe	--	Erosion with improper land use	Continued forest land mgmt; cross-slope opers; residue mgmt; irrigation mgmt.
ountain ops and idges	Sedimentary and basic igneous rock	Rocky silt loam	Stony loam or silt loam	Stones, cobbles & stones	20-35 in profile	0-40" over bedrock	Moderate in Pickett soil	Impervious	Good to excessive	Low to medium	VIIe	--	Erosion; stony & rocky profile	Forest land management
plands (steep ountains)	Igneous & sedimentary rock	--	--	--	--	0-10" over bedrock	--	Impervious	Good	Low to medium	VIIIs	--	Shallow over bedrock; steep slopes	--
plands (steep ountains)	Igneous & sedimentary rock	--	--	--	--	10-40" over bedrock	Moderate	--	Good	Low	VIe	--	Erosion with major cover disturbances	Continued forest land management

2

Table 225 - Continued

Soil Groups	Soil Association: Map Sym.	Soil Association: Elevation Feet	Soil Association: Precip. Inches	Soil Association: Freeze free Season Days	Soil Association: Major land use	Classification: Great Group or Subgroup	Classification: Family	Classification: Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Soil Characteristics: Texture Surface Soil	Soil Characteristics: Texture Subsoil	Soil Characteristics: Coarse Fragments Kind	Soil Characteristics: Coarse Fragments Percent	Soil Characteristics: Profile Depth
Shallow, rocky miscellaneous land with cold winters on strong to extremely steep slopes.	19	4,000-14,500	150-240	0-30	Other land Forest land[4/]	Rockland	--	Rockland[5/]	100	Uplands (steep mountains)	Igneous & sedimentary rock & volcanic material	--	--	--	--	10-60"+ over bedrock
Moderately deep to very deep, ashy soils with fine-loamy subsoils on gentle to steep slopes.	20	500-5,000	40-100	50-120	Forest land[4/]	Typic Dystrandepts	Ashy, mesic	Cinebar	50	Uplands (mountainous)	Volcanic ash & basic igneous rock	Silt loam	Silt loam	None	--	60"+ over volcanic ash or bedrock
						Xeric Haplohumults	Clayey, mixed, mesic	Olympic	20	Uplands (mountain slopes)	Basic igneous rock	Clay loam	Clay loam to silty clay loam	None	--	40-72" over bedrock
						Typic Haplorthods	Loamy-skeletal, mixed, mesic	Everett	10	Terraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile;60 below 20-36"	20-36" over gravel and sand
						Andic Glossoboric Hapludalfs	Fine, mixed, mesic	Wilkeson	5	Uplands (footslopes and side slopes)	Volcanic ash and basic igneous rock	Silty clay loam	Clay loam to clay	None	--	36-60"+ over bedrock

Table 225 - Continued

ition on dscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated[6/]	Major Soil Problems	Suitable Land Treatment and Structures
lands teep untains)	Igneous & sediment-ary rock & volcanic material	--	--	--	--	10-60"+ over bedrock	Moderate to *impervious*	--	Good	Low	VIIIs	--	Erosion with improper land use	Protection
lands ountain-s)	Volcanic ash & basic igneous rock	Silt loam	Silt loam	None	--	60"+ over volcanic ash or bedrock	Moderate	Moderate or *impervious*	Good	*High*	*IIe,IIIe* VIe,VIIe	--	*Erosion*; acid soil; ashy soil	Forest land management
lands ountain lopes)	Basic igneous rock	*Clay loam*	Clay loam to silty clay loam	None	--	40-72" over bedrock	Moderate	Impervious	Good	Medium and high	IIIe,IVe *VIe,VIIe*	--	Erosion	Forest land management
erraces	Glacial outwash	Gravelly sandy loam	Gravelly sandy loam	Gravel and sand	20-35 in profile;60 below 20-36"	20-36" over gravel and sand	Rapid	Very rapid	Somewhat excessive	Low	VIs VIIe	--	Erosion; moderately deep over gravel & sand;gravelly profile	Forest land management
plands footslopes nd side lopes)	Volcanic ash and basic igneous rock	*Silty clay loam*	Clay loam to clay	*None*	--	36-60"+ over bedrock	Very slow	Impervious	Good	Medium and high	VIe VIIe	--	Erosion; clayey subsoil; acid soil	Forest land management

2

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series 2/	Percentage 3/ of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth
	21	1,000-2,700	45-80	50-150	Forest land 4/	Andic Glossoboric Hapludalfs	Fine, mixed, mesic	Wilkeson	20	Uplands (footslopes and side slopes)	Volcanic ash and basic igneous rock	Silty clay loam	Clay loam to clay	None	--	36-60"+ over bedrock
						Xeric Haplohumults	Clayey, kaolinitic, mesic	Melbourne	20	Uplands (rolling to hilly)	Sedimentary rock (shale & sandstone)	Silty clay loam	Silty clay	None	--	40-60"+ over bedrock
						Typic Haplohumults	Clayey, mixed, mesic	Garrard	15	Uplands (mountain slopes)	Sedimentary rock (siltstone)	Clay loam	Silty clay	None	--	40-60" over bedrock
						Typic Dystrochrepts	Loamy-skeletal, mixed, mesic	Crescent	5	Fans and footslopes	Alluvium & colluvium	Loam	Sandy loam	None	--	60"+
Shallow to very deep ashy soils with fine-loamy subsoils and cold winters on strong to extremely steep slopes.	22	1,800-9,000	40-80	70-100	Forest land 4/ Other land (barren)	Cryandepts plus Cryumbrepts, Cryorthods, and Haplumbrepts	Ashy and cindery over loamy, mixed, frigid	--	100	Uplands (footslopes and side slopes) and mountainous slopes	Volcanic ash, sedimentary & basic igneous rock	--	--	--	--	10-60"+ over bedrock, sand or ash

1/ Based on data summarized during 1966.
2/ Only soil series names that have a status as reserved, tentative, or established are listed.
3/ Differences of total percentage in each soil association from 100 percent are inclusions of other soils and land types.
4/ For the upland forest soils, the above characteristics and qualities have been extended from a limited amount of survey data. Additional data and land use interpretations for forest soils are available in the Forest Land section of Appendix VIII, Land Measures and Watershed Protection. These areas include National Forest and adjacent non-Federal forest lands.
5/ Miscellaneous land types.
6/ Presently irrigated cropland.

SOURCE: National Cooperative Soil Survey.

Table 225 - Continued

Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
Uplands (footslopes and side slopes)	Volcanic ash and basic igneous rock	Silty clay loam	Clay loam to clay	None	--	36-60"+ over bedrock	Very slow	Impervious	Good	Medium and high	VIe VIIe	--	Erosion; clayey subsoil; acid soil	Forest land management
Uplands (rolling to hilly)	Sedimentary rock (shale & sandstone)	Silty clay loam	Silty clay	None	--	40-60"+ over bedrock	Moderately slow	Impervious	Good	Medium and high	IVe VIe VIIe	--	Erosion; clayey subsoil; acid soil	Forest land management
Uplands (mountain slopes)	Sedimentary rock (siltstone)	Clay loam	Silty clay	None	--	40-60" over bedrock	Moderately slow	Impervious	Good	Medium and high	VIe VIIe	--	Erosion; clayey subsoil; acid soil	Forest land management
Fans and footslopes	Alluvium & colluvium	Loam	Sandy loam	None	--	60"+	Rapid	Rapid	Good	Medium	VIs	--	Sandy profile	Forest land management
Uplands (footslopes and side slopes) and mountainous slopes	Volcanic ash, sedimentary & basic igneous rock	--	--	--	--	10-60"+ over bedrock, sand or ash	Moderately rapid	--	Good	Low to medium	VIe	--	Erosion with improper land use	Continued forest land management

and land types.
amount of survey data.
of Appendix VIII, Land
lands.

2

Table 227 - Summary and Distribution of Land Capability Classes, Subregion 11, 1966

Land Capability Classes	Distribution by Soil Associations1/ Soil Association Map Symbols2/	1,000 Acres	Percent	Inventoried 1,000 Acres3/
Class I - Soils in Class I have no limitations or hazards. They are adopted to all uses with a minimum of conservation treatment other than standard conditioning ones.4/	-	-	-	-
Class II - Soils in Class II have few limitations or hazards. Simple conservation practices are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	-	-	-	315.0
Class III - Soils in Class III have more limitations and hazards than those in Class II. They require more difficult or complex conservation practices when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	1-2-3 4-6-7	920.0	10.9	521.0
Class IV - Soils in Class IV have greater limitations and hazards than Class III. Still more difficult or complex measures are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	12	18.0	0.2	1,231.0
Class V - Soils in Class V have more limitations than Class IV. They are generally unsuited for cultivation, but are well suited for grazing and forestry use. They require good management practices.4/	-	-	-	-
Class VI - Soils in Class VI have severe limitations or hazards that make them generally unsuited for cultivation. They are suited largely to pasture, range, woodland or wildlife.	5-8-9-10-11 13-14-15-16 18-20-21-22	7,113.6	84.2	5,098.2
Class VII - Soils in Class VII have very severe limitations and hazards that make them generally unsuited for cultivation. They are suited to grazing, noncommercial, woodland or wildlife.	17	45.0	0.5	866.4
Class VIII - Soils and land forms in Class VIII have limitations and hazards that prevent their use for cultivated crops, pasture, range or woodland. They may be used for recreation, wildlife or water supply.	19	350.0	4.2	415.0
Total Land		8,446.6	100.0	8,446.6

1/ Class I and 10 percent of other capability classes may be included in areas of Class II. Up to 25 percent of other capability classes may be included in Classes III and IV. Class V and up to 40 percent of other capability classes may be included in Classes VI, VII, and VIII. In areas of rainfall less than 12 inches, large areas of Class VI can be potential Classes I through IV where irrigation water is available.
2/ Refer to the Subregional Soil Association Map, figure 47.
3/ Taken from table 8.
4/ Capability Classes I and V are distributed in small segregated areas over segments of the landscape. Many small areas could not be delineated on the map. This added detail, although still generalized, is commensurate with the subregional level of generalization.
Source: National Cooperative Soil Survey and U.S.D.A. Conservation Needs Inventory adjusted.

Table 228 - Water Storage Capacity of Soils Generalized to the Soil Associations, Subregion 11, 1966

Classes of Water Storage Capacity[1/]	Soil Association Symbols	1,000 Acres	Percent
Class A - Water storage in the soil profile more than 20,000 acre-feet per township.	1-2-3-4	740.0	8.8
Class B - Water storage in the soil profile 10,000 to 20,000 acre-feet per township.	16-20-21	845.0	10.0
Class C - Water storage in the soil profile 5,000 to 10,000 acre-feet per township.	5-6-7-8 9-10-11 12-13-22	3,538.0	41.9
Class D - Water storage in the soil profile less than 5,000 acre-feet per township.	17-19 14-15-18	3,323.6	39.3
Total		8,446.6	100.0

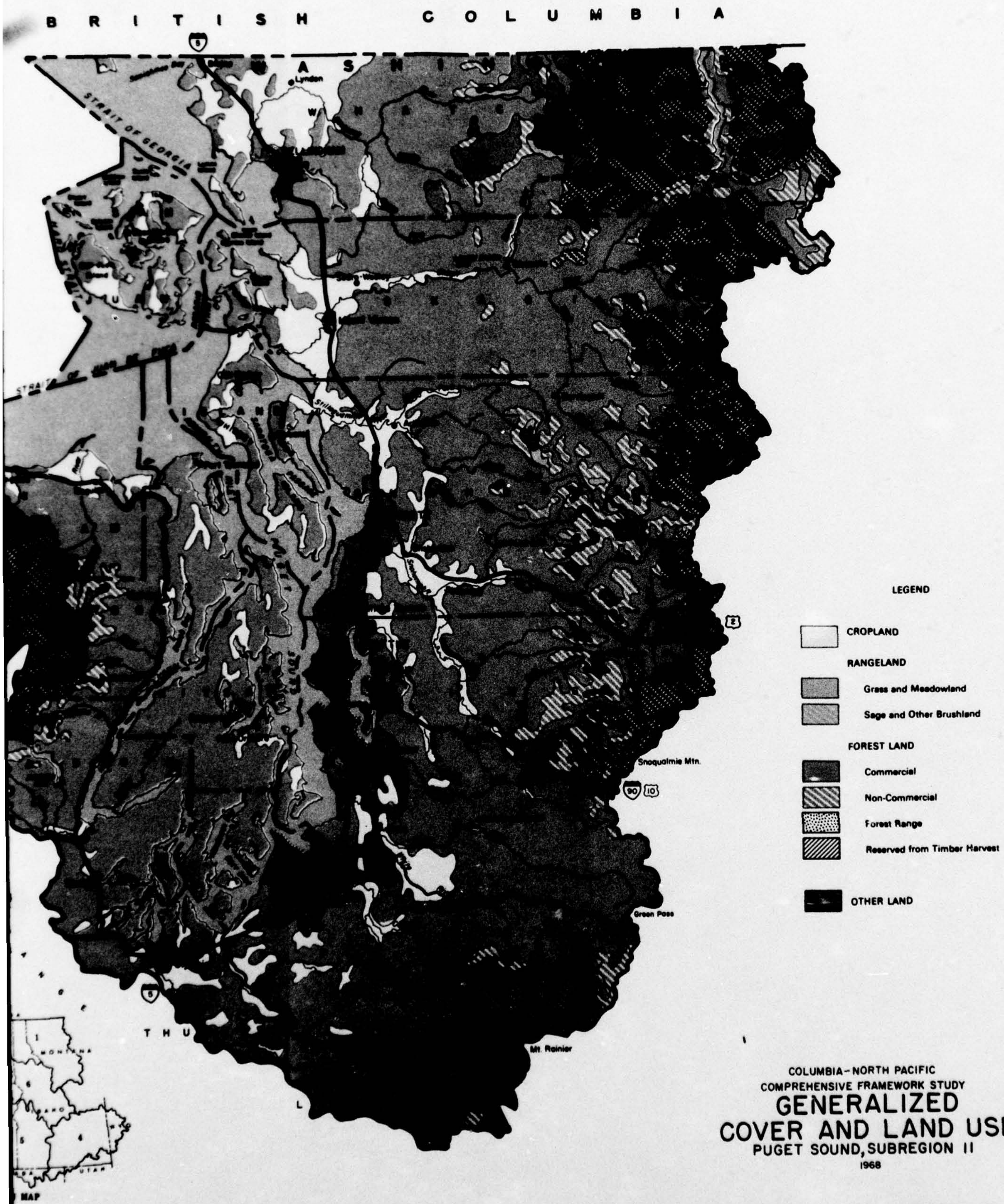
1/ Measurement of the water storage capacity is limited to the upper 5 feet of soil or bedrock.
Source National Cooperative Soil Survey.

Cover and Land Use

The four major cover and land uses, as defined in the glossary and explained in the introduction have been summarized by acreage and ownership on table 229. These broad categories have been determined both on the basis of cover and use. Cropland is more specifically a use category. Forest land has more than 10 percent forest cover. Rangeland areas have broad range cover characteristics. Other land includes land specifically based on use, such as urban, as well as that based specifically on cover characteristics such as rock and sand dune areas.

The four major categories have been generalized for presentation on figure 48. Since this information has been generalized, isolated areas of different cover and uses may occur within the broad patterns.


BRITISH
STRAIT OF GEORGIA
STRAIT OF JUAN DE FUCA
Lynden
Mount Vernon
Mt. Rainier
CANADA
MONTANA
OREGON
CALIF
NEVADA
UTAH
LOCATION MAP



COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

GENERALIZED COVER AND LAND USE

PUGET SOUND, SUBREGION II

1968

2

FIGURE 48

Table 229 - Cover and Land Use by Ownership, Subregion 11, 1966

Ownership	Cropland	Forest Land	Rangeland	Other Land	Total
			(1,000 acres)		
Department of Agriculture					
Forest Service	-	1,902.9	36.0	296.5	2,235.4
Other Agriculture	-	-	-	-	-
	-	1,902.9	36.0	296.5	2,235.4
Department of the Interior					
Bureau of Land Management	-	1.5	-	.1	1.6
Bureau of Indian Affairs 1/	4.1	24.8	1.2	4.1	34.2
National Park Service	-	779.8	16.8	286.7	1,083.3
Fish & Wildlife Service	-	.2	-	.3	.5
Bureau of Reclamation	-	-	-	-	-
Other Interior	-	-	-	.8	.8
	4.1	806.3	18.0	292.0	1,120.4
Department of Defense	-	73.4	-	48.6	122.0
Other Federal	-	2.3	-	3.8	6.1
Federal Subtotal	4.1	2,784.9	54.0	640.9	3,483.9
State	1.7	611.1	1.1	69.0	682.9
County	-	3.5	-	10.4	13.9
Municipal	-	146.3	-	71.1	217.4
Public Total	5.8	3,545.8	55.1	791.4	4,398.1
Private Total	585.2	2,883.2	49.9	530.2	4,048.5
Total Land Area	591.0	6,429.0	105.0	1,321.6	8,446.6

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.

Cropland

Generally the annual precipitation ranges widely over the area used for cropland. However, whether it is less than 20 inches (as in parts of Clallam or Jefferson counties) to over 60 inches (as in parts of Whatcom, Skagit, Snohomish, King, and Pierce counties), the natural cover is generally restricted to woody plants on well drained areas. Woody plants, such as cane fruits, certain tree fruits and nursery stock, produce well without the use of soil amendments. However, to grow successfully most other agricultural crops, such as grasses, cereals, legumes, roots, tubers and bulb crops, it is best to add lime or other amendments, and then increase the nutrient level with fertilizers. Natural precipitation is sufficient to obtain satisfactory yields of most crops without irrigation; however, the timely addition of supplemental water permits growing a wider range of crops with better quality and much higher yields. At present there are roughly 591,000 acres of cropland with over 15 percent (91,500 acres) presently irrigated.

Table 230 lists the acreage and extent of representative categories of crops grown. The Land Use and Cover Map, figure 48, shows the general location of cropland.

Table 230 - Cropland Acreage of Representative Categories of Crops, Subregion 11, 1965

Categories of Crops	Washington (1,000 acres)	Percent
Dryland Cropland 1/		
Close grown field crops	13.3	2.3
Forage crops	415.1	70.2
Row crops 2/	61.4	10.4
Orchards and vineyards	9.7	1.6
Total dryland crops	499.5	84.5
Irrigated Cropland 1/		
Close grown field crops	5.1	0.9
Forage crops	79.6	13.4
Row crops 2/	3.1	0.6
Orchards and vineyards	3.7	0.6
Total irrigated crops	91.5	15.5
Total cropland	591.0	100.0

1/ Taken from the Puget Sound and adjacent waters Type II Report.
2/ Includes vegetable seed crops, peas, beans, and corn.
Source: Puget Sound and Adjacent Waters Type II Report and U.S.D.A. Conservation Needs Inventory adjusted.

Forest Land

Forest land covers 6,429,000 acres or 76 percent of the total land area in Subregion 11. It dominates all but the Puget Sound trough, extending from timberline, downslope until it blends with the agricultural and urban lands on the basin floor. There is little open grazing land between the forests and highly developed croplands.

Over 3-1/2 million acres, or 55 percent of the forest land, are publicly owned. Of this public land 63 percent is national forest, 13 percent on areas administered by the Department of the Interior, 2 percent military reservation, and 22 percent owned by state and local governments. The balance, nearly 3 million acres or 45 percent, is privately owned, much in large industrial tree farms. Table 231 outlines this ownership in detail.

Timber A little over 5 million acres are classed as commercial forest land, about 80 percent softwood. The major species are the Douglas-fir, western hemlock, and true firs. Some of the finest stands of western red cedar are also found here. Hardwoods make up the balance. The remaining 1.4 million acres are classed as noncommercial forest, one-third on lands reserved from timber harvest, the other two-thirds on unproductive areas.

Table 231 - Forest Land Acreage by Generalized Type and Ownership, Subregion 11, 1966

Ownership	Commercial Forest Land	Productive Reserved	Unproductive Reserved (1,000 acres)	Unproductive	Total
Forest Service	1,294.5	172.6	109.3	326.5	1,902.9
Bureau of Land Management	1.5	-	-	-	1.5
Bureau of Indian Affairs1/	24.8	-	-	-	24.8
National Park Service	62.7	321.1	369.0	27.0	779.8
Fish & Wildlife Service	-	.2	-	-	.2
Bureau of Reclamation	-	-	-	-	-
Department of Defense	63.8	9.0	-	.6	73.4
Other Federal	-	2.3	-	-	2.3
Federal Subtotal	1,447.3	505.2	478.3	354.1	2,784.9
State	548.7	45.3	.3	16.8	611.1
County	-	3.5	-	-	3.5
Municipal	137.5	4.3	.1	4.4	146.3
Public Total	2,133.5	558.3	478.7	375.3	3,545.8
Private Total	2,870.8	-	-	12.4	2,883.2
Grand Total	5,004.3	558.3	478.7	387.7	6,429.0

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest Experiment Station.

Fifty-four percent of the commercial forest area is in the sawtimber class. Thirty-one percent is classed as pole timber and 14 percent seedlings and saplings. Only 1 percent is nonstocked. This subregion has the least area in uncut stands, the most in second-growth, also indicative of its history of early logging and development. The fact that only 1 percent is nonstocked points out both the natural regenerative ability and high level of forest management practiced. A little over half million acres of the commercial forest area have been reserved from timber harvest by park and wilderness-type classifications. The nonreserved balance supports nearly 135 billion board feet of commercial sawtimber, supplying raw material for a forest products industry which furnishes 20 percent of the subregion's manufacturing employment.

Forest Range The forest range in Subregion 11 includes 26,000 acres classified as commercial forest and 5,000 acres of noncommercial forest.

The forest range consists of small scattered parcels of forest land mostly adjacent to valley agricultural areas.

It is estimated that about 15 percent of the forest range is in good condition, 41 percent is in fair condition, and 44 percent is in poor condition. The approximate carrying capacity for

the forest range is 5,000 AUMs with the private range representing 69 percent and the public range 31 percent.

Other Uses Even though timber production is one of the key uses of the forest lands, they are equally important for other purposes. Over 94 percent of the subregion's stream runoff originates here. Nearly 1.2 million people, representing 90 percent of the area's urban population, depend on these forested watersheds for their source of domestic water.

The forest lands form a significant part of the subregion's recreation resource, furnishing vast areas for hunting, fishing, sightseeing, and other outdoor activities. The public forest land furnished areas and facilities for over 14-1/2 million recreation visits in 1965. These included use at developed recreation sites, winter sports areas, plus the general forest environment. The private forest lands furnished areas for another 90,000 visits during this period. The forest lands furnish most of the deer, elk, bear, and small game habitat. About a half-million hunter visits were recorded on forest areas in 1965.

Rangeland In Subregion 11, 105,000 acres are reported to be rangeland. This is little more than 1 percent of the total land area. This subregion accounts for less than 1 percent of all rangeland in the region. Table 232 shows the different categories of rangeland by ownership.

Table 232 - Rangeland and Forest Range Acreage by Range Type and Ownership, Subregion 11, 1966

Category	Federal					Non-Federal		
	BLM	FS	BIA	Other	Total	State & County	Private	Grand Total
	(1,000 acres)							
Rangeland								
Grasslands	-	33.3	-	16.8	50.1	1.1	14.5	65.7
Sagebrush	-	-	-	-	-	-	-	-
Brushland other than sage	-	2.7	1.2	-	3.9	-	35.4	39.3
Total	-	36.0	1.2	16.8	54.0	1.1	49.9	105.0
Forest Range[1/]								
Commercial Forest	-	11.8	-	-	11.8	-	14.0	25.8
Noncommercial Forest								
Sub-alpine	-	-	-	-	-	-	5.3	5.3
Desert Fringe	-	-	-	-	-	-	-	-
Total (noncommercial)	-	-	-	-	-	-	-	-
Total (forest range)	-	11.8	-	-	11.8	-	19.3	31.1
Grand Total	-	47.8	1.2	16.8	65.8	1.1	69.2	136.1

1/ Forest and woodland grazed or potentially usable for forage production. Forest range acreage is included within the total forest statistics shown on table 231.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

The range is found in small parcels intermingled with cropland and forest land throughout lower elevations of the subregion and in scattered mountain meadows at higher elevations to the east. Most was previously forest land, now covered with brush, weeds, and grass but generally unsuitable for more intensive agricultural production.

About 17 percent of the rangeland is in good condition, 35 percent is in fair condition, and 48 percent is in poor condition. The approximate carrying capacity is 15,000 AUMs with private lands accounting for 55 percent and public lands 45 percent.

Other Land

The other land use in Subregion 11 consists of 1,321,600 acres or about 15.5 percent of the land area. This includes barren land and rock in the alpine areas that make up about 48.5 percent of the total. Another 48.5 percent of the total is urban, industrial areas, farmsteads, airports, roads, and other miscellaneous use areas. About 3 percent consists of water areas less than 40 acres and streams less than one-eighth mile wide. Table 233 shows the acreage and extent of other land in the Puget Sound Subregion.

Table 233 - Other Land, Subregion 11, 1966

Kinds of Land Use	Washington (1,000 acres)	Percent
Barren	640.9	48.5
Roads and railroads	72.9	5.5
Small water 1/	40.5	3.1
Miscellaneous 2/	567.3	42.9
Total Other Land	1,321.6	100.0

1/ Water areas less than 40 acres in size and streams less than one-eighth mile in width.
2/ Includes urban and industrial areas, farmsteads, airports, and other areas.
Source: Compiled by the Soil Conservation Service Columbia-North Pacific River Basin Staff.

MINERAL RESOURCES

The eastern half of the subregion is the western flank of the North Cascade Range and the western half lies in the Puget Sound Basin. This accounts for a widely divergent geologic setting and a wide diversity of mineral resources. The Cascade Range is underlain by intrusive plutonic rocks of Jurassic, Cretaceous, and Tertiary age; metamorphic and metasedimentary rocks of pre-Jurassic age; older volcanic flow rocks of Carboniferous age; and Recent volcanic flows from the present volcanic cones. The Puget Sound Basin is covered predominantly by continental and marine sediments of early Tertiary age and Pleistocene glacial and fluvial sand, gravel, and glacial drift.

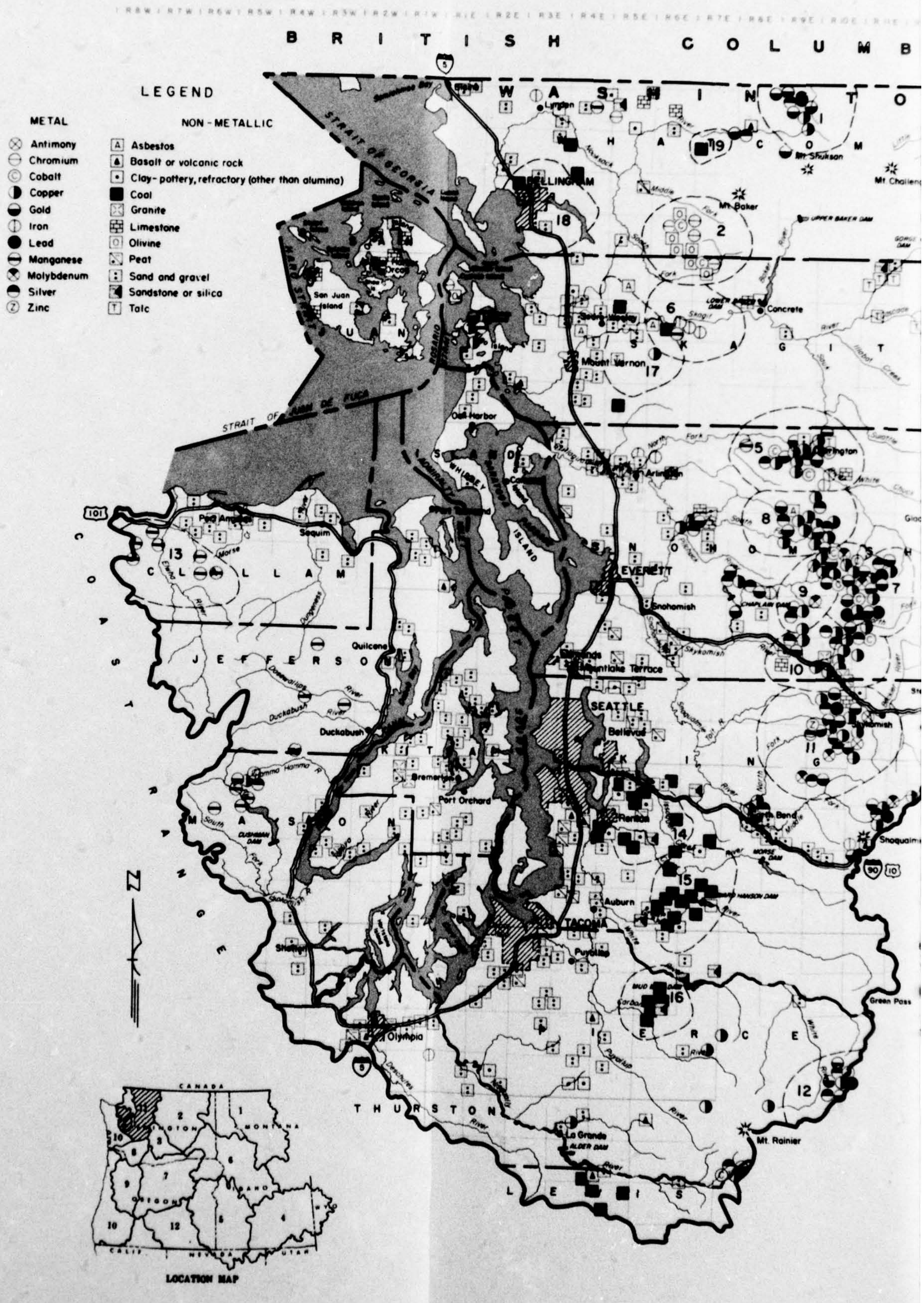
Metals, Nonmetals, and Mineral Fuels

The large number of copper deposits (with associated gold, silver, and lead) present in the North Cascades occur in a broad belt on the margins of the Snoqualmie and Chilliwack batholiths (granodiorite intrusions of Tertiary age). The metal deposits are mostly in the metasedimentary and metamorphic rocks bordering the batholith but some are in the granodiorite.

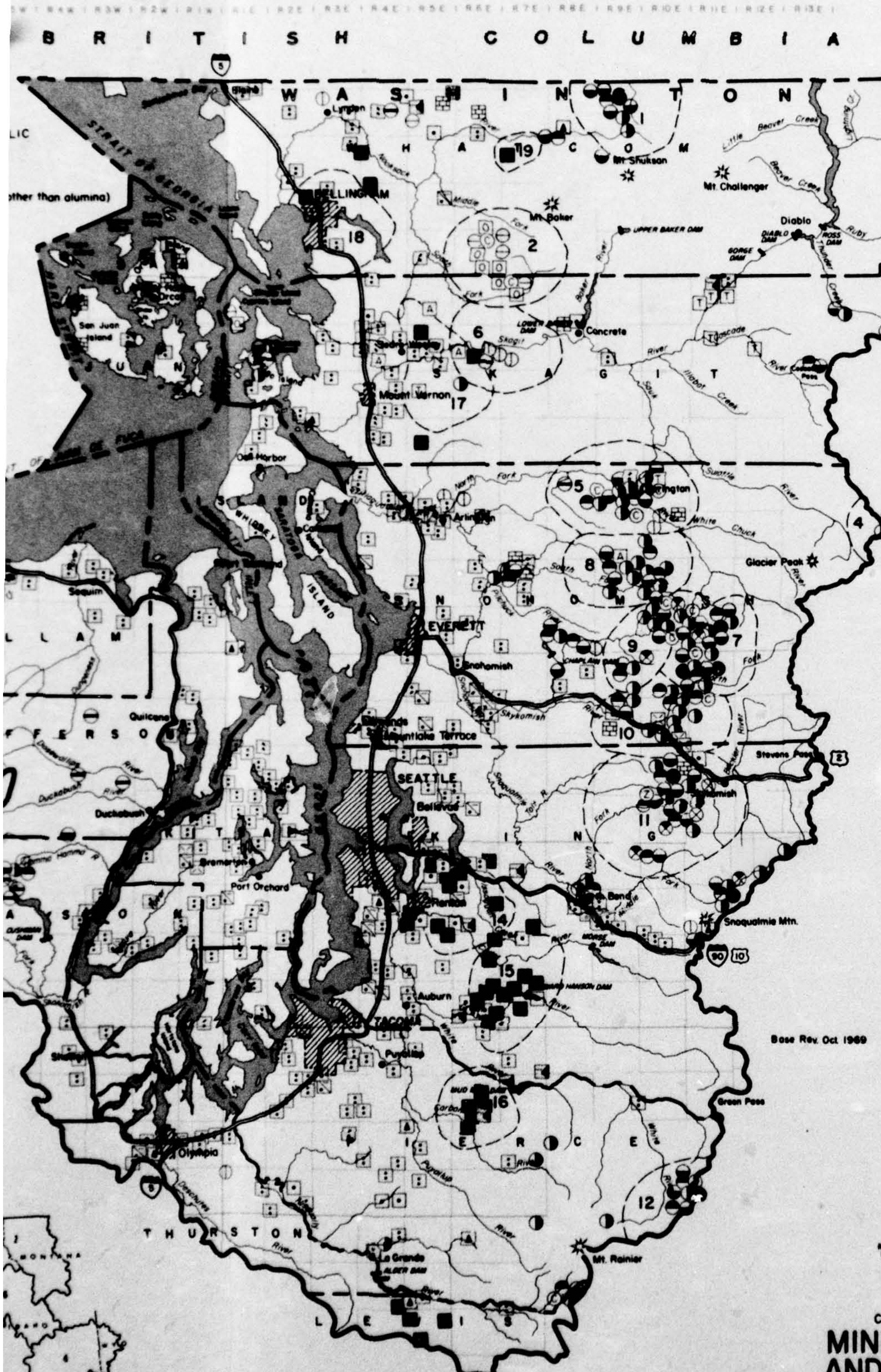
Gold has been the most important metal produced in the Nooksack River drainage. Deposits containing gold (with minor amounts of silver, copper, lead) are found in the Mount Baker District near the head of the North Fork of the Nooksack (figure 49 and table 234). Total production in the district has been about 44,000 ounces of gold with a small amount of copper, silver, and lead. Other metallic minerals occur in this drainage area including deposits of nickel, chrome, and iron.

More than 100 million tons of limestone reserves are present in the North Fork drainage near Limestone Junction, about 15 to 20 miles northeast of Bellingham; about 2.5 to 3 million tons of limestone have been produced from these deposits for cement and paper pulp manufacture in Whatcom County. The largest known reserves of olivine in the Nation are found in the Twin Sisters Range between the Middle and South Forks of the Nooksack. The deposits cover an area 4 miles wide and 10 miles long and contain an estimated 160 billion tons of reserves. Sand and gravel occurs in outwash glacial deposits and in river bars and terraces in the Nooksack River drainage. Clay deposits are fairly common in the lower Nooksack River drainage. There are several deposits of refractory clay near Kendall. Three clay pits in this area have produced an estimated 53,400 tons and estimated reserves are about 1.5 million tons. An operating clay pit at Brennan provides clay for cement manufacture and another near Nooksack furnishes clay for heavy clay products. A silica deposit west of Limestone Junction has been quarried for use in manufacture of low-temperature cement; reserves are estimated to about 50,000 tons. Coal fields are located near Bellingham, Lake Whatcom, and near Glacier. The Bellingham field has produced 6 million tons and was the site of the first coal mine in the State of Washington. Total estimated coal reserves in the Nooksack River drainage are about 298 million tons.

The drainage of the Skagit River and its tributaries, the Sauk and the Suiattle rivers, contain many metallic mineral deposits. The Darrington District, the Monte Cristo-Silver Creek District, the Slate Creek District, and the Glacier Peak District are all located in the Skagit drainage. The Slate Creek District has produced about 150,000 ounces of gold, less than 10,000 ounces of silver, and 5 tons of lead. The Glacier Peak District is only partly within Subregion 11. The Monte Cristo-Silver Creek District



BRITISH COLUMB
WASHINGTON
LEGEND
METAL
Antimony
Chromium
Cobalt
Copper
Gold
Iron
Lead
Manganese
Molybdenum
Silver
Zinc
NON-METALLIC
Asbestos
Basalt or volcanic rock
Clay-pottery, refractory (other than alumina)
Coal
Granite
Limestone
Olivine
Peat
Sand and gravel
Sandstone or silica
Talc
STRAIT OF GEORGIA
STRAIT OF JUAN DE FUCA
San Juan Island
BELLINGHAM
Mt. Baker
Mt. Shuksan
Concrete
Mount Vernon
Oak Harbor
Arlington
EVERETT
Snohomish
Port Angeles
Sequim
CLALLAM
JEFFERSON
Quilcene
Duckabush
MASON
Bremerton
Port Orchard
SEATTLE
Bellevue
Renton
Auburn
TACOMA
Puyallup
Shelton
Olympia
THURSTON
PIERCE
LEWIS
La Grande
ALDER DAM
Mt. Rainier
Green Pass
Shoqualmie
North Bend
COAST RANGE
LOCATION MAP
CANADA
MONTANA
OREGON
IDAHO
NEVADA
CALIF.
UTAH



MINING DISTRICTS

1 Mount Baker
2 Twin Sisters
3 Slate Cr.
4 *Glacier Peak*
5 Darrington
6 Hamilton
7 Monte Cristo-Silver Cr.
8 Silverton
9 Sultan Basin
10 Index
11 Buena Vista-Money Cr.
12 Summit
13 Crescent
14 Newcastle
15 Green River
16 Wilkeson-Carbonado
17 Cokedale-Hamilton
18 Bellingham
19 Glacier

10 0 10 20
SCALE IN MILES

COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

MINERAL RESOURCES AND MINING DISTRICTS

PUGET SOUND, SUBREGION II

1 FIGURE 49

Table 234 - Mining Districts, Subregion 11

Index No. Fig.	District	County	Drainage	Size of Districts - Production plus Potential Reserves 1/ Gold	Silver	Copper	Lead	Zinc	References
1	Mount Baker	Whatcom	Upper reach of the North Fork Nooksack River	2 1/	2 1/	3 1/	3 1/	-	Patty, E.N., 1921, Wash.Geol.Survey Bull. 23, 366 pp.
2	Twin Sisters	Whatcom-Skagit	Upper reaches of the South and Middle Forks of Nooksack River	Several thousand tons of high grade, and large amount of low grade chromite and 160 billion tons of olivine present. Some production of both.					Huntting, M.T., 1956, Wash. Div. of Mines & Geol., Bull. 37, v. 1 and 2.
3	Slate Creek	Whatcom	Slate Creek, upper Ruby Creek, tributary to Skagit River	1	3	-	3	-	Purdy, C.P., 1952, Wash. Div. of Mines & Geol. Inf. Circ. 20, 74 pp.
4	Glacier Peak	Snohomish	Headwaters of Suiattle River, tributary to Sauk River	2 No production but large reserves proven by exploration. Some molybdenum associated with copper.	-	1	-	-	Huntting, M.T., 1956.
5	Darrington	Snohomish	Middle reach of Sauk River.	3 Some iron deposits - no production	-	3	-	-	Broughton, W.A., 1942, Wash. Div. of Inv. 6, 64 pp.
6	Hamilton	Skagit	Middle reach of Skagit River.	Iron deposits (Iron Mountain). Production about 5,000 tons. Estimated 600,000 tons reserve. Also coal deposits nearby					Zapffe, C., 1949, Wash. Div. of Mines & Geol., Raw Materials Survey Rept. 5, 89 pp.
7	Monte Cristo-Silver Creek	Snohomish	Headwaters of S. Fork Sauk River.	1	1	3	1	1	Spurr, J.E., 1901, U.S. Geol. Survey 22nd Annual Rept. Pt. 2, pp. 777-865.
8	Silverton	do	Headwaters of S.Fork Stillaguamish River	1	3	2	3	-	Broughton, W.A., 1942
9	Sultan Basin	do	Headwaters of the Sultan River.	3 About 50 tons of molybdenum produced in association with gold-silver mining.	3	1	-	-	Carithers, Wanol Guard, A.K., 1945, Wash.Div. of Mines and Geol. Bull. 36, 89 pp.
10	Index	Snohomish	N. Fork of Skykomish River.	3	2	2	-	-	Huntting, M.T., 1956
11	Buena Vista-Money Creek	do	S. Fork of Skykomish River.	2	3	3	-	-	Purdy, 1952
12	Summit	Pierce	Headwaters of the White River.	3	2	3	-	-	Purdy, C.P., Wash.Div. of Mines & Geol. Bull 39, 186 pp.
14	Newcastle-Grand Ridge; Renton; Cedar Mt.; Tiger Mt.; Taylor,(Coal)	King	Cedar River Basin.	Produced about 22 million tons of coal. Reserves estimated at 450 million tons.					Beikman,H.M., et al, 1961, Wash.Div. of Mines & Geol. Bull. 47, 115 pp.
15	Green River (coal)	do	Green River.	Produced more than 25 million tons of coal. Reserves are estimated to exceed 357 million tons.					do
16	Wilkeson-Carbonado (coal)	Pierce	Carbon River, tributary to the Puyallup River.	Produced more than 21 million tons of coal. Reserves are estimated at about 348 million tons.					do
17	Cokedale-Hamilton (coal)	Skagit	Skagit River.	Produced about 180,000 tons of coal. Reserves are estimated at about 507 million tons.					Beikman, H. M., et al, 1961, Wash. Div. of Mines & Geol. Bull. 47, 115 pp.
18	Bellingham; Lake Whatcom; Blue Canyon; (coal)	Whatcom	Nooksack River.	Produced nearly 6 million tons of coal. Reserves are estimated at about 325 million tons.					do
19	Glacier (coal)	do	do	Produced less than 1,000 tons of anthracite coal. Reserves are estimated at about 5 million tons.					do

1/ Size

Index	Gold (Troy Ounces)	Silver (Troy Ounces)	Copper (Net Tons)	Lead (Net Tons)	Zinc (Net Tons)
1	50,000 - 200,000	More than 1,000,000	More than 10,000	50 - 5,000	50 - 5,000
2	10,000 - 50,000	10,000 -1,000,000	1,000 - 10,000	5 - 50	5 - 50
3	Less than 10,000	Less than 10,000	100 - 1,000	Less than 5	Less than 5

has produced 228,000 ounces of gold, more than 1 million ounces of silver, about 5,000 tons of lead, and a small amount of copper and molybdenum. There are iron deposits along the Skagit River near Hamilton; about 5,000 tons have been produced and estimated reserves are 600,000 tons averaging 38 percent iron.

Nonmetallic minerals of importance in the Skagit River drainage are limestone, olivine, silica, and talc; there are minor occurrences of pumicite, diatomite, and asbestos material. Some decorative stone and flagstone have been produced. Sand and gravel and clay deposits are common in the Lower Skagit River Basin.

The Stillaguamish River drainage has produced copper, silver, gold, and iron minerals, as well as sand, gravel, and limestone. The metallic mineral output has come from the Silverton District in the upper drainage of the South Fork of the Stillaguamish. Production has been about 100,000 ounces of gold, less than 10,000 ounces of silver, 5 tons of lead, plus a small amount of copper. About 6,000 tons of bog iron ore came from the Jefferson deposit northeast of Arlington; other iron deposits occur near Darrington. Limestone is an important mineral commodity in the Stillaguamish Basin; production is estimated to have been more than 500,000 tons and reserves are in excess of 39 million tons. Deposits are located near Darrington and Silverton. Sand and gravel deposits of economic value occur as river bars and terraces along the Stillaguamish River. Coal deposits are found in the Hamilton and Rich Creek coal areas. There has been a small production, and reserves are estimated at about 45 million tons.

The Snohomish River drainage contains more metallic mineral deposits than any other drainage in Subregion 11. The metals, copper, gold, silver, antimony and iron, have been produced as well as construction materials such as sand and gravel, limestone, clay, and miscellaneous stone. The Sultan Basin District on the Sultan River has produced about 240 tons of copper; less than 10,000 ounces of gold, 10,000 ounces of silver, and 50 tons of molybdenum. The Index District on the North Fork of Skykomish River has produced 7,000 tons of copper, less than 10,000 ounces of gold, and more than 100,000 ounces of silver. The Buena Vista-Money Creek District has produced less than 100 tons of copper, 11,000 ounces of gold, and a small amount of silver. Limestone deposits are found near Granite Falls on Pilchuck Creek and near Grotto on the Skykomish River. The deposits near Grotto have been quarried since 1928 for cement manufacture in a plant at Grotto. Total production is estimated to be about 2 million tons, reserves are estimated to be about 7.5 million tons. Sand and gravel occurs as glacial outwash and as river bars in the Skykomish and Snoqualmie rivers. Sand-gravel pits are shown in figure 49. Clay deposits are relatively widespread in the Snohomish River Basin; however, only a few are actively worked. Coal beds are found on the Raging River and about

25,000 tons of coal have been produced from this area; reserves amount to about 14 million tons.

The Cedar River drainage contains important coal resources and has been a major coal producing area. A few metallic mineral occurrences are present, but little or no production of metals has been made. Sand and gravel and clay have been important mineral products in this basin. Sand and gravel pits and basalt and other volcanic rock quarries are shown in figure 49; silica sand for glass manufacture is being produced at one pit. There are about 15 clay pits, four of which produce refractory clay. Two pits are capable of producing a bloating or expanding clay. Coal fields in the Cedar River drainage include the Renton, Newcastle-Grand Ridge, Cedar Mountain, Tiger Mountain, and Taylor. More than 22 million tons of coal have come from these deposits and reserves are estimated to be about 450 million tons.

The Green River drainage has produced more coal than any other drainage in the subregion. Total production is estimated to be about 25 million tons and remaining resources are estimated as 357 million tons of coal. Stone is an important product from this area. Two quarries have been operating continuously for many years; basalt rock is quarried for rubble, riprap, and crushed rock. Production figures are not available. Sand and gravel production is of minor importance. About 500,000 tons of clay have been produced in the Green River Basin; part of this tonnage is refractory clay and a substantial reserve of refractory clay exists. A few silica sand deposits are known, one of which is presently producing. Peat is found in several localities and some peat is being produced. Mercury occurs in one or two deposits near Black Diamond; about 20 flasks have been produced.

The White-Puyallup River drainages contained occurrences of copper, gold, silver, lead, and zinc in the Summit District near the headwaters of the White River. A small production of copper and silver came from one mine; several test shipments were made at other properties in the district. Gold was produced at three lode deposits and one placer. A production of 10,000 or more ounces of silver and small amounts of copper were made. Exceptional sand and gravel deposits are present in this drainage; the deposits near Steilacoom are of good quality and located on tidewater. Thirteen companies are producing in this locality (1966) and supply most of the sand and gravel for the Seattle area.

The Wilkinson-Carbonado coal field is located near the Carbon River. Formerly one of the principal coal producing districts in Washington, it contains one of the best coking coals in the State. Total production has been more than 21 million tons; reserves are estimated to be about 348 million tons. Stone is produced from several basalt quarries and one ornamental building standstone quarry. There are four producing peat operations in the drainage.

The Nisqually River drainage contains several metal deposits in the upper part of the drainage; less than 200 tons of copper and a small amount of silver and gold have been produced. Clay has been produced from several localities, the most important of which is that near Clay City on the headwaters of Tanwax and Ohop Creeks. Coal deposits are present in the Ashford area near Mineral Lake. A very small amount has been mined; reserves are limited. Sand and gravel has been an important product of this basin; several stone quarries are shown on figure 49.

The San Juan Islands drainage principal mined product is limestone. Production started in 1882 and was virtually continuous until very recently; total production is estimated at about 9 million tons and reserves are in the range of 5 million tons.

Whidbey Island produces sand and gravel and is noted for considerable reserves of peat. To the north, Fidalgo Island contains some occurrences of copper and gold minerals and strontium deposits.

The Elwha-Dungeness River drainages contain numerous low grade manganese deposits.

Jefferson, Kitsap, and Mason counties contain several manganese deposits, some occurrences of gold, silver, copper, and iron; there are numerous productive sand and gravel pits, peat operations, and a few stone quarries. A few tons of copper ore were produced many years ago from one prospect, and a small production of manganese ore came from three deposits. Iron ore was produced near Chimacum and used in an iron blast furnace at Irondale on Port Townsend Bay in 1880; there is no record of the amount produced. Sand and gravel is widespread. Peat bogs cover more than 5,000 acres in the area; four producers were active in 1966. Several basalt stone quarries, two granite quarries, and one sandstone quarry have been active.

Present Mineral Industry and Outlook for the Future

Metals

Subregion 11 has produced about 7,000 tons of copper through 1964 (table 235). The largest production came from the Sunset mine in the Index District. The largest number of copper deposits in the state are found in this subregion which includes the Glacier Peak, Index, Sultan, Silver Creek Monte Cristo, Silverton, and Darrington districts. Very little copper has been mined in recent years, but there is considerable exploration activity. The area is considered to be favorable for discovery of potentially economic

Table 235 - Mineral Production, Subregion 11 1/

Type	Quantity 2/ (thousands)	Value (thousands)	Counties Where Produced	Years of Recorded Production
Nonmetals				
Abrasives	W	W	Pierce, Skagit	1923-43, 1946-47
Asbestos	W	W	Skagit	1930-34
Clay	2,501	$ 2,897	King, Pierce, Skagit, Snohomish, Whatcom	1933-64
Cement (376-pound barrels)	127,230	319,319	King, Skagit, Whatcom	1909-64
Lime	597	8,791	King, Pierce, San Juan, Snohomish, Whatcom	1935-56, 1963-64
Olivine	W	W	Skagit, Whatcom	1946-64
Pumice	1	2	King, Skagit, Snohomish	1946-52, 1955-56
Sand and gravel	161,275	118,182	All counties	1935-64
Silica sand	492	2,864	King, Pierce, Skagit, Whatcom	1937-64
Stone	45,909	71,935	All counties	1929, 1933, 1937-64
Strontium	W	W	Skagit	1940-42, 1946, 1953, 1956-59
Talc	93	601	Skagit	1933-64
Undistributed 4/	109	3,031		
Total Nonmetals 5/		$527,620		
Fuels				
Coal	69,260	214,912	King, Pierce, Skagit, Thurston, Whatcom	1900-64
Peat	306	1,522	King, Kitsap, Pierce, Skagit, Snohomish, Thurston	1957-64
Total Fuels 5/		$216,434		
Metals 6/				
Gold (troy ounces)	107	2,689	Clallam, King, Pierce, Skagit, Snohomish, Whatcom	1904-64
Silver (troy ounces)	343	230	Clallam, King, Pierce, Skagit, Snohomish, Whatcom	1904-49, 1951-62
Copper	7	2,252	King, Pierce, Skagit, Snohomish, Whatcom	1904-11, 1914-30, 1933-49, 1951-56, 1958-62
Lead-zinc	(3/)	3	King, Pierce, Skagit, Snohomish Whatcom	1908, 1910, 1914, 1916, 1918, 1922, 1924-41, 1949, 1951-53, 1961
Chromite	(2/)	10	Skagit	1917-18, 1956, 1958-59
Iron ore	35	W	Snohomish	1907-10
Manganese (35 percent or more Mn)	(2/)	W	Clallam, Mason	1916, 1924-26, 1942-46, 1952-53, 1959
Mercury	W	W	King	1957-58
Undistributed 7/		67		
Total Metals 5/		$ 7,095		
Total Mineral Industry 5/		$751,150		

W Figure withheld to avoid disclosing individual company confidential data.
1/ 1900-64.
2/ Short tons unless otherwise specified.
3/ Less than 500 tons.
4/ Value of nonmetal items that cannot be disclosed: abrasives, asbestos, olivine, strontium.
5/ Figures in columns may not add to total because of rounding.
6/ Recoverable content of ores, etc.
7/ Value of metal items that cannot be disclosed: iron ore, mercury, and molybdenum.

copper deposits. Largest known copper reserves are in the Glacier Peak deposit. Exploration drilling has indicated 30 to 50 million tons of low grade copper ore at Glacier Peak; however, the property is in the Glacier Peak Wilderness Area, and future development may be deterred as a result of wilderness regulations.

Gold and Silver Gold has contributed the largest total value of any metal in Subregion 11. Total recorded output has been about 107,000 ounces. Most of this output has come from the Mt. Baker and Slate Creek districts in Whatcom County. Much of the gold was produced during depression year 1935-1940. Less than 500 ounces annually have been produced since 1940. The present low production rate for gold in the Nation is due, in part, to the imbalance between production costs and the market price for gold. There is a potential for future gold production from several districts under a more favorable economic climate for gold mining.

About 343,000 ounces of silver and less than 500 tons of lead and zinc have been produced, mostly as byproduct of copper mining. Future output will depend on future copper production.

Manganese, Chromite, Mercury, and Others Manganese deposits are numerous in the western part of the subregion, mostly on the Olympic Peninsula in Clallam, Jefferson, and Mason counties. Most of the deposits are small and of low grade. The potential resources of manganese have not been determined. A few tons of chromite ore have been mined in Skagit County. About 35,000 tons of iron ore have come from Snohomish County, and a few flasks of mercury were produced in King County. None of these metals is currently produced, and there is no apparent significant future potential at this time.

Nonmetals

Construction Materials Cement production is probably the most important mineral industry. Cement plants are located at Seattle, Bellingham, and Grotto. Total production of cement to 1964 has been 127.3 million barrels (376 pounds per barrel), valued at $319.3 million. The raw mineral materials used in cement manufacture are cement rock (argillaceous limestone), limestone, clay and siliceous materials, gypsum, and, in some types of cement, iron ore. About 1.5 million tons of these minerals were used for cement production in 1964. A large amount of limestone is imported from Texada Island, B.C. Otherwise the raw materials come from subregional deposits.

Fire clay for refractory products and miscellaneous or common clay for brick and structural clay products are mined in

the subregion. The 1964 total clay production was 106,800 tons, valued at $126,300. King County produces most of the clay, and the Renton area is the center of the ceramic industry. Other clay producing counties are Pierce, Skagit, Snohomish, and Whatcom.

Structural clay products and, to a lesser extent, refractory clay products, are meeting increasing competition from other materials so that the potential for future expansion is questionable. The clay resources are adequate for all foreseeable future demands; thus production will depend on the marketability of the clay products.

Sand and gravel is an important mineral product both in tonnage and total value. There were 79 commercial sand and gravel plants in operation in 1964 that produced 9.9 million tons of gravel. For the period 1935-64, 161.3 million tons of gravel valued at $118.2 million were produced from all the counties in the subregion. In 1965, sand and gravel ranked first in order of value of minerals produced in San Juan, Island, Snohomish, Clallam, Kitsap, and Pierce counties. Sand and gravel resources are generally adequate for future demand except in local areas where other land uses, such as urban expansion and urban zoning have discouraged or prohibited operations. The moving of sand and gravel operations to deposits at greater distances from markets will eventually result in higher prices to the consumer.

Stone is produced in every county; recently active quarries are shown in figure 49. Basalt or traprock accounted for 75 percent of the stone produced in 1964; most of the remaining 25 percent was limestone. Some granite, marble, and dimension stone was produced. The total stone production in 1964 was 3.5 million tons valued at $5.9 million. In 1965, stone ranked first in value of production in Jefferson and Mason counties, and second in value of production in Clallam, San Juan, Snohomish, and Whatcom counties. Stone deposits are generally adequate for all potential future needs except in local areas where conflicting land uses limit availability of many sites, and in instances where special qualifications or specifications limit the suitable deposits.

Olivine Olivine is produced from the Twin Sisters deposits in Skagit and Whatcom counties. Production was started in 1946 and has been continuous to the present. It is marketed principally for use as foundry sand. Production figures are not available. Reserves in the Twin Sisters deposits are in the range of 160 billion tons, enough for production many times the present rate for many years in the future.

Peat Peat production is a substantial industry. Nearly all peat production in Washington comes from the Puget Sound Basin, and the State ranked first in peat output for the Nation during the period 1951-54. Production in 1964 was from 15 operations in King, Snohomish, Thurston, Kitsap, Pierce, and Skagit counties; total production was 35,000 tons valued at $170,500. Resources at active operations are estimated at 2 million tons. Output is likely to increase as consumption by gardeners and nurseries increases in the marketing area.

Silica A 100-ton-per-day silica plant is operating near Auburn, King County, treating sands produced from nearby deposits.

Talc A small amount of talc (soapstone) is produced in Skagit County. Production has declined from 8,900 tons in 1952 to 2,700 tons in 1964. Future outlook for increased production is not favorable.

Mineral Fuels

Formerly the second most valuable mineral produced was coal. Total output from 1900 to 1964 was 69.3 million tons valued at $214.9 million. In 1964 only a small tonnage was produced in the Green River District, King County, and Wilkeson-Carbonado District, Pierce County. Total remaining reserves were estimated to be about 2,021 million tons as of January 1, 1960. The coal beds in the Puget Sound Basin are structurally in a highly disturbed belt; beds often dip at high angles and are displaced by faulting; this contributes to a high mining cost, so it often cannot compete economically with other regions. Some of the reserves in Pierce County are of coking quality, and their future potential as metallurgical coal is more promising. Development of thermal electric generating capacity to supplement hydroelectric power in the near future provides a more promising future potential use for the coal reserves.

A number of test wells have been drilled for oil and gas; however, there have been no commercial oil and gas discoveries to date.

S U B R E G I O N 12
O R E G O N C L O S E D B A S I N

ABSTRACT

The Oregon Closed Basin ranks eighth in size among the subregions. It includes an area in south-central Oregon bordering on Nevada and drains east and south to the Great Basin.

The land resource consists of three main areas of use and physiography.

Approximately 77 percent of the land area is presently devoted to rangeland use. It occurs on the basaltic lava plain with a shallow overburden of wind deposited silt and volcanic ash; on the terraces of sandy, silty, and clayey lacustrian sediments; and in old lake basins on alluvial sediments. Rather extensive and concentrated salt and alkali areas are common to these basins. Over most of this area precipitation normally ranges from about 8 to 12 inches annually and the frost-free period from 80 to 110 days. Limitations of use relate to shallow, rocky, wet, salty, and alkali soils, and environmental factors of low rainfall and a short growing season.

About 16 percent of the land area is under forest cover and has dual forest and grazing use. The forest cover occurs on the north, west, and southwest margin of the subregion above 5,000 feet elevation. In the northwest, shallow, erosive soils are formed in pumice and volcanic ash overburden on a basalt plateau. On the southwest margin erosive soils are formed in acid igneous residuum/colluvium and on the north side the moderately deep soils are formed in a mixture of volcanic ash, loess, and basaltic residuum/colluvium. Precipitation normally ranges from 16 to 20 inches and the growing season varies from 30 to 90 days.

About 3 percent of the land is cropland of which about 87 percent is irrigated and 13 percent dryland. Irrigated cropland is concentrated on bottomlands in closed lake basins and dryland cropland on adjacent lacustrian terraces. Precipitation on the dryland cropland area normally ranges from 10 to 14 inches and precipitation on the irrigated cropland is somewhat less.

About 4 percent of the land is classified under other land and consists mainly of barren lava rock areas, rim rock (escarpments), and talus.

Mercury is the only important metal produced in Subregion 12. The Opalite District, Malheur County, in the southeastern corner of the subregion, has produced more than 26,000 flasks of mercury; it is the second most productive mercury district in Oregon. The Opalite and Bretz mines have accounted for nearly all the mercury output except for a few flasks produced from mines in the Steens and Pueblo Mountains. An open pit mercury deposit at Glass Buttes was under development in 1966.

Pumice and pumiceous materials (volcanic cinder and scoria) are very plentiful and have been mined on a small scale for light-weight aggregate, cinder block, and road material; resources are significant and would supply a much larger industry if markets could be developed. Saline deposits in the pluvial lakes represent a source material for a future chemical industry.

The total area of Subregion 12 consists of mostly land with about one-half percent water. Table 236 shows the land, water, and total acreages by state and counties. Except for table 236, only the areas of land will be recorded in acreages throughout the following discussion.

Table 236 - Areas by State and County, Subregion 12, 1967

State and County	Water Area Sq.Mi.	Water Area Acres	Land Area1/ Sq. Mi.	Land Area1/ Acres	Total Area Sq. Mi.	Total Area Acres
Oregon						
Crook	0.0	0	17.3	11,100	17.3	11,100
Deschutes	0.0	0	348.9	223,300	348.9	223,300
Grant	0.0	0	454.4	290,800	454.4	290,800
Harney	49.7	31,800	8,727.6	5,585,700	8,777.3	5,617,500
Klamath	1.8	1,100	245.3	157,000	247.1	158,100
Lake	43.6	27,900	6,986.4	4,471,300	7,030.0	4,499,200
Malheur	4.2	2,700	1,024.4	655,600	1,028.6	658,300
Total	99.3	63,500	17,804.3	11,394,800	17,903.6	11,458,300
Total Subregion	99.3	63,500	17,804.3	11,394,800	17,903.6	11,458,300

1/ The term "land" is defined to include all water bodies under 40 acres and streams under one-eighth mile in width.

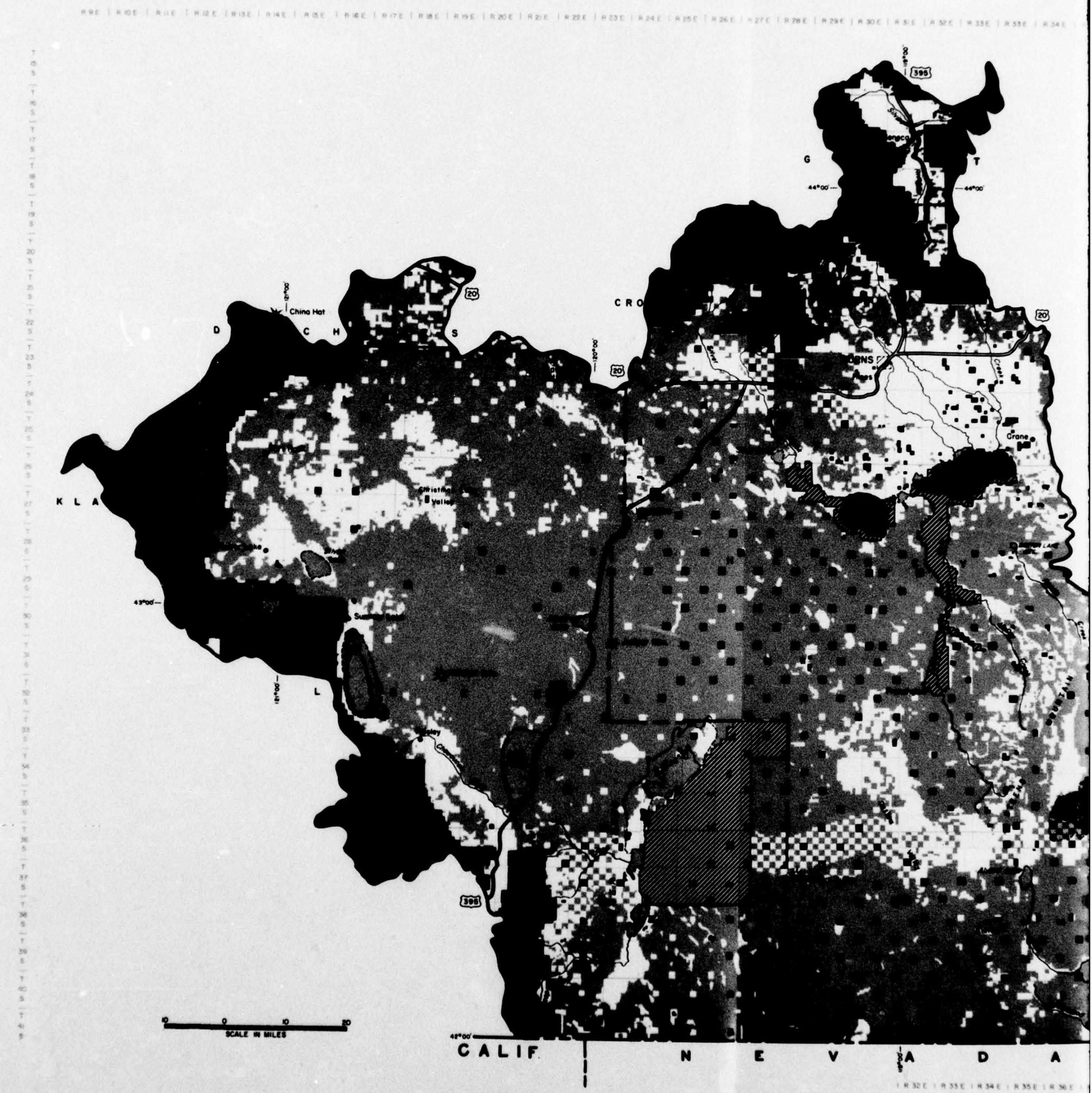
Source: U.S.D.A. Conservation Needs Inventory adjusted to the U.S. Census

LAND

Factors of major importance to the land resource are: the ownership status, the soils, and the present use. The combination of these factors greatly influences the present and future utilization of the land resource

Land Ownership

Subregion 12 contains nearly 11.4 million acres. The largest single landowner is the Federal Government with 8.3 million acres or



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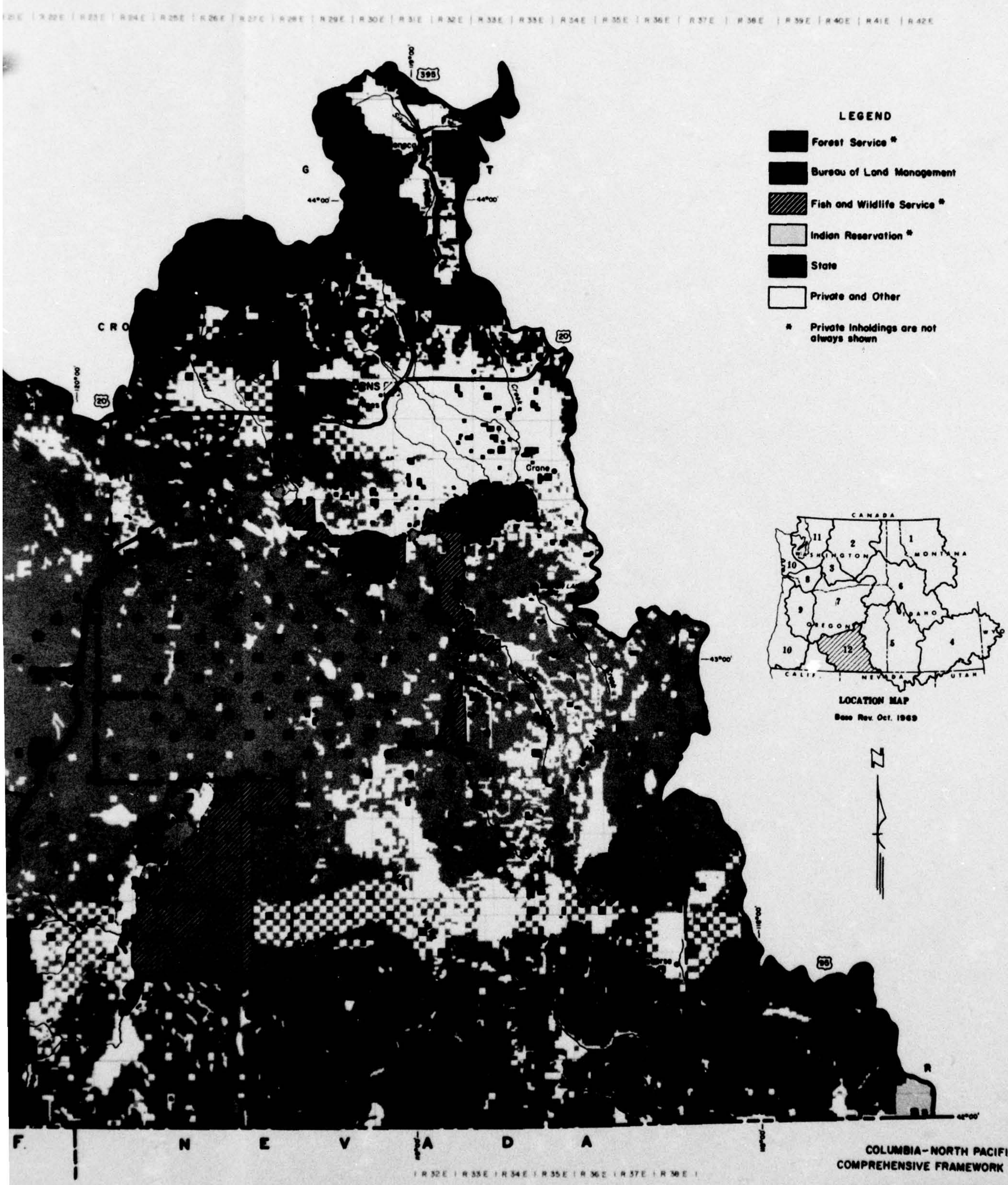


COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

LAND OWNERSHIP

OREGON CLOSED BASIN SUBREGION 12

1968

2

FIGURE 50

73 percent of the total land area. Private ownerships amount to over 2.7 million acres or 24 percent of the total area. State, county, and municipal ownerships make up the balance.

Almost 6.5 million acres of the public lands are Public Domain, administered by the Bureau of Land Management. Another 1.4 million acres are national forest. Over 400,000 acres are in wildlife refuges and over 300,000 acres are owned by the State of Oregon. About 30,000 acres are Indian Reservations.

Table 237, Land Ownership, and figure 50, Land Ownership Map, show this information in more detail.

Table 237 - Land Ownership Acreage, Subregion 12, 1965

Administering Agencies	Oregon (1,000 acres)
Department of Agriculture	
Forest Service	1,363.7
Other Agriculture	14.6
Subtotal	1,378.3
Department of the Interior	
Bureau of Land Management	6,476.7
Bureau of Indian Affairs 1/	30.2
National Park Service	-
Fish & Wildlife Service	426.8
Bureau of Reclamation	-
Other Interior	-
Subtotal	6,933.7
Department of Defense	-
Other Federal	-
Federal Subtotal	8,312.0
State	330.0
County	3.6
Municipal	.5
Public Non-Federal Subtotal	334.1
Total Public	8,646.1
Total Private	2,748.7
Grand Total	11,394.8

1/ Private lands held in trust by the Federal Government.
Source: General Services Administration Real Property Owned by the United States as of June 30, 1965, adjusted by the Land and Minerals Work Group.

Soils

Figure 51, Soil Associations Map, shows the location and relative extent of each soil association. The associations are numbered in a general relationship to the position in the landscape. Thus, bottomlands and low terraces have the lowest numbers and alpine areas have the highest. The name of each association relates to the soil series representing general kinds of soils that are most extensive in the landscape. Wherever possible, established soil series are

used in the name; however, where the soil series do not have classification status, the soil series name is not recorded. Generally up to 15 percent of any soil association in known areas may consist of inclusions of soils other than those identified. Such inclusions may be similar soils or they may be highly contrasting. However, in many high, mountainous areas where detailed knowledge about the area is incomplete, extensive areas are included within delineations and inclusions of other soils may exceed the 15 percent general average.

Table 238 contains information about each soil association on the map. The symbol listed in the second column on the table is the same symbol shown on the soil associations map.

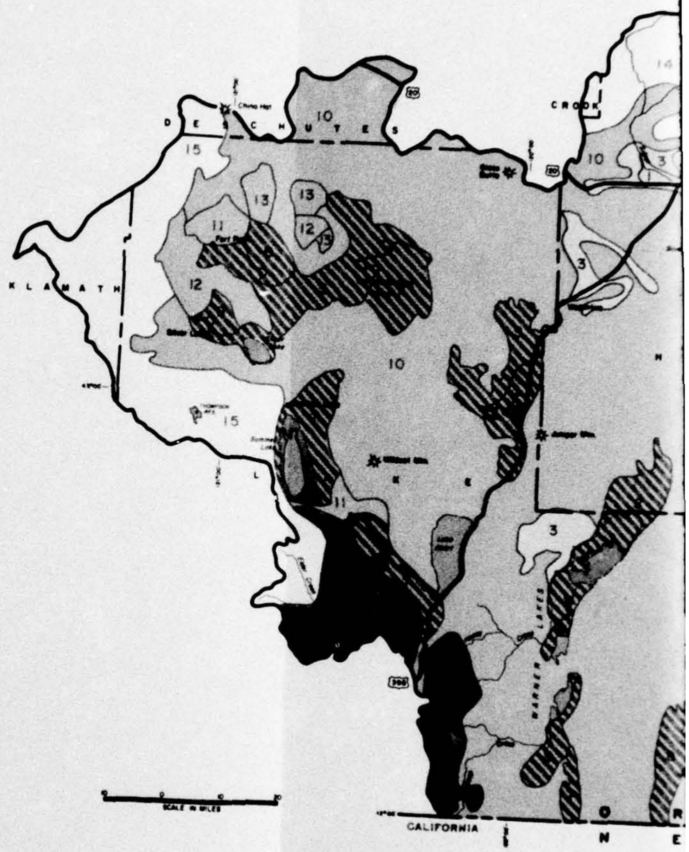
The table is organized to show land characteristics and the characteristics, qualities, and some interpretations of soil series representing the dominant and the contrasting kinds of soil in each association. The first six columns show some general land characteristics for each soil association. The next 11 columns show characteristics (permanent soil facts) of individual key soil series that represent dominant and contrasting soils. The following four show qualities inferred from the characteristics of these soils, and the last four columns show interpretations concerning agricultural use based upon the foregoing soil characteristics and qualities. All of the representative soil series listed have status in classifications. A blank space in the soil series column indicates that the soil series name has no classification status.

The "soil groups" column contains associations that have broad similarities in some important characteristics frequently idenfified with a position on the landscape.

The "percentage of association" column shows the extent of each soil in an association. Differences of the total soil percentage in each association from 100 percent are inclusions of other soils and land types. For example, soil association 8 lists a total of 70 percent. Knowledge of this area is limited, so 30 percent of the area consists of inclusions of soils that have not been defined.

Terms listed for permeability of water through the subsoil and permeability of substratum are:

Very rapid: Over 10 inches per hour.
Rapid: 5 to 10 inches per hour.
Moderately rapid: 2.50 to 5 inches per hour.
Moderate: 0.8 to 2.5 inches per hour.
Moderately slow: 0.2 to 0.8 inches per hour.
Slow: 0.05 to 0.2 inches per hour.
Very slow: Less than 0.05 inches per hour.



LEGEND REVISED 1970

LEGEND

Soil Associations Name of Association
Map Symbol *

Generally silty and sandy soils formed in alluvial sediments on bottomlands and low terraces.

1	Powder
3	Duripan

Generally silty and clayey soils with somewhat restricted subsoil and substrata permeability formed in stratified sediments on terraces, basins and hilly upland.

4	Umapine - Stanfield
5	Fort Rock - Flagstaff
6	Durorthids
7	Flagstaff
8	Frigid Soils
9	Ozamis

Generally silty soils formed in materials m
rocky residuum-colluvium from basic rock
plateaus, canyons and mountains.

10	Hart - Plush
11	Bonnick - Fort Rock
12	Bonnick
13	Rockland

Generally sandy soils formed in materials
volcanic ash or pumice on terraces, foothi
and mountains.

14	Dominantly Argixerolls
15	Dominantly Xeropsamment

Generally sandy soils formed in materials m
rocky residuum-colluvium from acidic rock
races, foothills and mountains.

16	Dominantly Argixerolls
17	Booth - Lorella

** Symbols are non-conotative and consistent only subregion. To compare delineations from one subre another refer to the name of the Soil Association.*

NOTE: The Soil Association name may include a s not fit the Soil Associations Group description. Th iation name is based on dominant series. The domi series may be only 30 percent of the Soil Associati clayey textured soil series may be included in a gro described as generally silty and sandy in texture.

REVISED 1970

GEND

of Association

ndy soils formed in alluvial
nds and low terraces.

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layey soils with somewhat restric-
ata permeability formed in strat-
races, basins and hilly upland.

oine - Stanfield
Rock - Flagstaff
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staff
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Generally silty soils formed in materials mixed with rocky residuum-colluvium from basic rock types on plateaus, canyons and mountains.

10	Hart - Plush
11	Bonnick - Fort Rock
12	Bonnick
13	Rockland

Generally sandy soils formed in materials mixed with volcanic ash or pumice on terraces, foothills, plateaus and mountains.

14	Dominantly Argixerolls
15	Dominantly Xeropsamments

Generally sandy soils formed in materials mixed with rocky residuum-colluvium from acidic rock types on terraces, foothills and mountains.

16	Dominantly Argixerolls
17	Booth - Lorella

** Symbols are non-conotative and consistent only within each subregion. To compare delineations from one subregion to another refer to the name of the Soil Association.*

NOTE: The Soil Association name may include a series that does not fit the Soil Associations Group description. The Soil Association name is based on dominant series. The dominant of five series may be only 30 percent of the Soil Association. Thus a clayey textured soil series may be included in a group accurately described as generally silty and sandy in texture.

COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

SOIL ASSOCIATIONS

OREGON CLOSED BASIN
SUBREGION 12

FIGURE 51

2

Table 238 - Characteristics and Qualities of Representative Soils, Subregion 12[1/]

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth	Pe
Moderately deep to very deep soils with loamy subsoils on nearly level slopes.	1	4,000-4,400	8-12	90-120	Cropland (hay, pasture and cereals) - 85% irrigated	Cumulic Haplaquolls	Fine, mixed, non-calcareous, mesic		25	Flood plains	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Mo sl
					Rangeland	Aquic Haploxerolls	Fine, mixed, mesic		20	Flood plains	Alluvium	Silty clay	Fine sandy loam	None	--	26-30" over clayey material	Mo ra
						Typic Haplorthents	Fine-loamy, mixed, calcareous, mesic		15	Flood plains	Alluvium	Silt loam to silty clay loam	Loam	None	--	60"+	Mo
						Aridic Cumulic Haploxerolls	Coarse-silty, mixed, mesic	Powder	10	Fans and flood plains	Alluvium	Silt loam	Loam	None	--	60"+	Mo
						Histic Haplaquolls	Fine-silty, mixed, mesic		10	Flood plains	Alluvium	Silt loam	Silt loam	Gravel	60 below 36-60"	36-60" over gravel	Mo
						Haplorthents	Coarse-loamy over skeletal, mixed, mesic		5	Fans and terraces	Alluvium	Gravelly sandy loam	Gravelly loam	Gravel	20-35 in profile; 60 below 20-36"	20-36" over gravel	Mo
	2	4,000-5,000	12-16	100-120	Cropland (alfalfa and pasture)-irrigated (cereals)-dryland	Cumulic Haploxerolls	Fine-loamy, mixed, mesic	Lakeview	70	Bottomlands	Alluvium	Loam and silty clay loam	Clay loam	None	--	60"+	Mo sl
					Rangeland	Pachic Argixerolls	Fine-loamy, mixed, mesic	Drews	10	Terraces	Lake sediments	Loam	Clay loam	None	--	40-60" over cemented sediments	Mo sl
						Argic Durixerolls	Fine, montmorillonitic, mesic	Mesman	5	Terraces	Lake sediments	Loam	Gravelly clay	Gravel	20-35 below 10"	20-40" over hardpan	Sl
Shallow to very deep, frigid soils with gravelly, loamy subsoils on nearly level to gentle slopes.	3	4,000-5,500	8-12	90-120	Rangeland	Haplic Durargids	Fine-loamy, mixed, frigid		70	Fans and terraces	Alluvium	Gravelly loam	Gravelly loam	Gravel	20-35 in profile	8-20" over silica duripan	Mo
					Cropland (hay) irrigated	Aridic Cumulic Haploxerolls	Coarse, silty, mixed, mesic	Powder	10	Fans and flood plains	Alluvium	Silt loam	Loam	None	--	60"+	Mo
						Typic Camborthids	Fine-silty, mixed, frigid		5	Basins & playas	Alluvium	Silt loam	Silt loam	None	--	16" over semi-consolidated sediments	Mo

Table 238 - Characteristics and Qualities of Representative Soils, Subregion 12[1/]

Per-cent of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated[6/]	Major Soil Problems	Suitable Land Treatment and Structures
25	Flood plains	Alluvium	Silt loam	Silty clay loam	None	--	60"+	Moderately slow	Moderately slow	Somewhat poor	High	IIIw	IIIw	Wetness	Drainage; irrigation mgmt; residue mgmt.
20	Flood plains	Alluvium	Silty clay	Fine sandy loam	None	--	26-30" over clayey material	Moderately rapid	Very slow	Very poor	Medium and high	VIw	VIw	Wetness; moderately deep over clayey material	Drainage;irrigation mgmt; residue mgmt;pastureland management
15	Flood plains	Alluvium	Silt loam to silty clay loam	Loam	None	--	60"+	Moderate	Moderate	Somewhat poor	High	IVs	IVs	Wetness; alkaline soil	Drainage;soil amendments; irrigation mgmt; residue mgmt; pastureland mgmt.
10	Fans and flood plains	Alluvium	Silt loam	Loam	None	--	60"+	Moderate	Moderate	Good	High	IIe IIc	IIe IIc	Erosion; droughtiness	Irrigation mgmt; residue mgmt; cropping sequence; rangeland management
10	Flood plains	Alluvium	Silt loam	Silt loam	Gravel	60 below 36-60"	36-60" over gravel	Moderate	Very rapid	Somewhat poor	Medium and high	IIIw	IIIw	Wetness	Drainage;irrigation mgmt; residue management
5	Fans and terraces	Alluvium	Gravelly sandy loam	Gravelly loam	Gravel	20-35 in profile; 60 below 20-36"	20-36" over gravel	Moderate	Very rapid	Good	Low	IIIs	IIIs	Moderately deep over gravel;gravelly profile;droughtiness	Irrigation mgmt;residue mgmt; cropping sequence; rangeland mgmt.
70	Bottom-lands	Alluvium	Loam and silty clay loam	Clay loam	None	--	60"+	Moderately slow	Moderately slow	Moderately good	High	IIw	IIw	Wetness	Drainage; irrigation management
10	Terraces	Lake sediments	Loam	Clay loam	None	--	40-60" over cemented sediments	Moderately slow	Very slow & impervious	Good	Medium and high	IIc	IIc	Climate	Irrigation mgmt; rangeland management
5	Terraces	Lake sediments	Loam	Gravelly clay	Gravel	20-35 below 10"	20-40" over hardpan	Slow	Impervious in hardpan	Moderately good	Low	IIIs	IIIs	Moderately deep over hardpan; gravelly subsoil	Irrigation mgmt; rangeland management
70	Fans and terraces	Alluvium	Gravelly loam	Gravelly loam	Gravel	20-35 in profile	8-20" over silica duripan	Moderate	Impervious in duripan	Good	Low	*VIe*	*IIIs* IVe	Erosion; shallow over duripan; gravelly profile	*Rangeland management*
10	Fans and flood plains	Alluvium	Silt loam	Loam	None	--	60"+	Moderate	Moderate	Good	High	IIc	IIc	Droughtiness	Irrigation mgmt;residue mgmt; rangeland mgmt.
5	Basins & playas	Alluvium	Silt loam	Silt loam	None	--	16" over semi-consolidated sediments	Moderate	Impervious in substratum	Good	Low	VIs	IIIs	Erosion; shallow over sediments	Rangeland management

2

Table 238 - Continued

Soil Association: Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Percent	Profile Depth	Perme... Su...
Very deep soils with loamy and clayey subsoils on gentle to moderate slopes.	4	4,000-4,400	8-12	90-120	Cropland (pasture & hay) - limited irrigation	Haplargid-Natrargids	Fine-silty, mixed, mesic		30	Old lake basins	Lake sediments	Sandy loam to silt loam	Silt loam	None	--	60"+	Moder
						Andic Haplaquepts	Coarse-silty, mixed, calcareous, mesic	Umapine	15	Old lake basins	Lake sediments	Silt loam	Loam	None	--	60"+	Moder
						Aquic Durorthids	Coarse-silty, mixed, mesic	Stanfield	10	Old lake basins	Lake sediments	Silt loam	Silt loam	None	--	20-36" over hardpan	Modera
						Argiaquollic-Argialbolls	Fine, montmorillonitic, mesic		10	Old lake basins	Lake sediments	Silt loam	Clay	None	--	60"+	Slow
						Natrargids	Fine, mixed, mesic		10	Old lake basins	Lake sediments	Silt loam	Clay	None	--	60"+	Slow
						Haplaquolls	Fine-silty, mixed, mesic		10	Old lake basins	Lake sediments	Silt loam to silty clay loam	Silt loam	None	--	60"+	Modera
Shallow to moderately deep, frigid soils over hardpan and sandy and loamy subsoils on nearly level to gentle slopes.	5	4,000-5,000	8-10	90-100	Rangeland Cropland (alfalfa and pasture) - irrigated (pasture)-dryland	Xerollic Camborthids	Coarse-loamy, mixed, frigid	Fort Rock	70	Basins	Lake sediments	Loam	Loam	None	--	20-40" over hardpan	Modera
						Haplic Xerollic Durargids	Fine-loamy, mixed, mesic	Flagstaff	10	Basins	Lake sediments	Silt loam	Silty clay loam	None	--	20-40" over hardpan	Modera slow
						Typic Torriorthents	Mixed, frigid	Horning	5	Beach ridges	Lake sediments and sand	Loamy sand	Loamy sand	None	--	60"+	Very r
	6	4,000-5,000	8-10	90-100	Rangeland Cropland (limited pasture)-70% irrigated	Xerollic Durorthids	Sandy, mixed, frigid		75	Basins	Lake sediments	Loamy sand	Loamy fine sand	None	--	7-20" over hardpan	Rapid
						Xerollic Calciorthids	Coarse-loamy, mixed, frigid	Fort Rock	10	Basins	Lake sediments	Loam	Loam	None	--	20-40" over hardpan	Modera

Table 238 - Continued

Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Irrigated 6/	Major Soil Problems	Suitable Land Treatment and Structures
Old lake basins	Lake sediments	Sandy loam to silt loam	Silt loam	None	--	60"+	Moderate	Moderate	Good	High	VIs	--	Alkaline soil	Soil amendments; pastureland management
Old lake basins	Lake sediments	Silt loam	Loam	None	--	60"+	Moderate	Moderate	Somewhat poor	High	VIs	--	Wetness; alkaline soil	Drainage; soil amendments; pastureland management
Old lake basins	Lake sediments	Silt loam	Silt loam	None	--	20-36" over hardpan	Moderate	Impervious in hardpan	Somewhat poor and poor	Low	VIs	--	Moderately deep over hardpan; alkaline soil	Soil amendments; pastureland management
Old lake basins	Lake sediments	Silt loam	Clay	None	--	60"+	Slow	Slow	Somewhat poor	High	IIIw	IIIw	Wetness; clay subsoil	Drainage; irrigation mgmt; pastureland management
Old lake basins	Lake sediments	Silt loam	Clay	None	--	60"+	Slow	Slow	Poor	High	VIw VIs	--	Wetness; alkaline soil; clay subsoil	Drainage; soil amendments; pastureland management
Old lake basins	Lake sediments	Silt loam to silty clay loam	Silt loam	None	--	60"+	Moderate	Moderate	Somewhat poor and poor	High	VIw VIs	--	Wetness; alkaline soil	Drainage; soil amendments pastureland management
Basins	Lake sediments	Loam	Loam	None	--	20-40" over hardpan	Moderate	Impervious in hardpan	Good	Low and medium	IVc	IVc	Moderately deep over hardpan; droughtiness	Rangeland mgmt; irrigation management
Basins	Lake sediments	Silt loam	Silty clay loam	None	--	20-40" over hardpan	Moderately slow	Impervious in hardpan	Somewhat poor	Low and medium	VIs	--	Moderately deep over hardpan; alkaline soil	Rangeland management
Beach ridges	Lake sediments and sand	Loamy sand	Loamy sand	None	--	60"+	Very rapid	Very rapid	Excessive	Low	VIs	--	Sandy and alkaline soil	Rangeland management
Basins	Lake sediments	Loamy sand	Loamy fine sand	None	--	7-20" over hardpan	Rapid	Impervious in hardpan	Somewhat excessive	Low	VIe	--	Shallow over hardpan; sandy profile; alkaline soil	Rangeland management
Basins	Lake sediments	Loam	Loam	None	--	20-40" over hardpan	Moderate	Impervious in hardpan	Good	Low and medium	IVc	IVc	Moderately deep over hardpan; droughtiness	Rangeland mgmt; irrigation management

2

Table 238 - Continued

Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profil
	Soil Association					Classification						Soil Characteristics				
	7	4,000-5,000	8-10	90-130	Rangeland	Haplic Xerollic Durargids	Fine-loamy, mixed, mesic	Flagstaff	35	Basins and terraces	Lake sediments	Silt loam	Silty clay loam	None	--	20-40" hardpa
					Cropland (limited pasture)-50% irrigated	--	--	Duneland[5/]	35	Terraces (hummochy)	Sand	Fine sand	Fine sand	None	--	60"+
						--	--	Playa[5/]	15	Basins	Lake sediments	Silty clay loam	Silty clay	None	--	40-60" cement sedime
Very deep to shallow, frigid soils with clayey subsoils on nearly level slopes.	8	4,000-4,400	8-12	90-120	Rangeland	Haplorthents	Fine, mixed, mesic		35	Lake basins	Lake sediments	Silty clay	Silty clay	None	--	60"+
					Cropland (hay, pasture, and cereals)-85% irrigated	Camborthids	Fine-silty, mixed		25	Lake basins	Lake sediments	Silt loam	Silt loam	None	--	16-24" silica
						Argiustolls	Fine, mixed, mesic		15	Lake basins	Lake sediments	Silt loam	Clay	None	--	16-24" silica
						Entic Normaquerts	Fine, montmorillonitic, mesic		10	Lake basins	Lake sediments	Clay	Clay	None	--	60"+
Moderately deep soils over watertable with loamy subsoils on nearly level slopes.	9	4,000-5,000	8-10	100-130	Cropland (hay, pasture, alfalfa and cereals) - irrigated	Histic Haplaquolls	Coarse-silty, siliceous, noncalcareous, mesic		35	Lake bottoms	Lake sediments	Muck	Silt	None	--	20-40" water t
					Rangeland	Typic Haplaquolls	Fine-loamy, mixed, noncalcareous, mesic	Ozamis	35	Lake bottoms	Lake sediments	Silty clay loam	Silty clay loam	None	--	20-40" water t
						Xerollic Durorthids	Coarse-loamy, mixed, mesic	Henley	10	Terraces	Alluvium	Loam	Loam	None	--	20-40" hardpan

Table 238 - Continued

...s [2]	Percentage of Assn. [3]	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Range of: Major Capability Subclass: Irrigated [6]	Major Soil Problems	Suitable Land Treatment and Structures
...taff	35	Basins and terraces	Lake sediments	Silt loam	Silty clay *loam*	None	--	20-40" over hardpan	Moderately slow	Impervious in hardpan	Somewhat poor	Low and medium	VIs	--	Moderately deep over hardpan; alklaline soil	Rangeland management
...and [5]	35	Terraces (hummochy)	Sand	Fine sand	Fine sand	None	--	60"+	Very rapid	Very rapid	Excessive	Low	VIIe	--	Erosion; sandy profile	Duneland stabilization
...[5]	15	Basins	Lake sediments	Silty clay loam	Silty clay	None	--	40-60" over cemented sediments	Slow	Very slow & impervious	Poor	Medium and high	VIIw	--	Wetness; alkaline and clayey profile	Rangeland management (limited)
	35	Lake basins	Lake sediments	Silty clay	Silty clay	None	--	60"+	Slow	Slow	Somewhat poor and moderately good	High	IIIw IVw	IIIw IVw	Wetness	Drainage; pastureland mgmt; *irrigation* management
	25	Lake basins	Lake sediments	Silt loam	Silt loam	None	--	16-24" over silica hardpan	Moderate	Impervious in hardpan	Good	Low	IVe IVs	IVe IVs	Erosion; shallow over hardpan	Pastureland mgmt; irrigation management
	15	Lake basins	Lake sediments	Silt loam	Clay	None	--	16-24" over silica hardpan	Slow	Impervious in hardpan	Good	Low	IVe IVs	IVe IVs	Erosion; shallow over hardpan; clay subsoil	Pastureland mgmt; irrigation management
	10	Lake basins	Lake sediments	Clay	Clay	None	--	60"+	Slow	Slow	Somewhat poor and poor	High	IVw VIw	IVw	Wetness; clayey profile	Drainage; pastureland mgmt; irrigation mgmt.
	35	Lake bottoms	Lake sediments	Muck	Silt	None	--	20-40" over water table	Moderate	Impervious	Very poor	High	--	IIIw	Moderately deep over water table; organic soil; drainage	Drainage; irrigation management
...is	35	Lake bottoms	Lake sediments	Silty clay loam	Silty clay loam	None	--	20-40" over water table	Moderately slow	Impervious	Poor	High	Vw	Vw	Moderately deep over water table	Drainage; irrigation mgmt; rangeland mgmt.
...ey	10	Terraces	Alluvium	Loam	Loam	None	--	20-40" over hardpan	Moderate	Impervious in hardpan	Somewhat poor	Low and medium	IVw	IVw	Moderately deep over hardpan; wetness; alkaline soil	Drainage; soil amendments; irrigation mgmt; rangeland management

2

Table 238 - Continued

Soil Groups	Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Great Group or Subgroup	Family	Series[2]	Percentage[3] of Assn.	Position on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments Kind	Coarse Fragments Percent	Profile Depth	Per
Shallow to deep, frigid soils with stony, clayey subsoils on gentle to steep slopes.	10	4,000-8,000	8-15	80-120	Rangeland Cropland (irrigated hay and pasture) - limited	Lithic Xerollic Haplargids	Clayey, mixed, frigid	Hart	25	Uplands (gently sloping plateaus)	Basic igneous rock	Very stony loam	Clay	Stones	35-80 in top 10"	10-20" over bedrock	Slo
						Abruptic Xerollic Durargids	Clayey, montmorillonitic, frigid, shallow		25	Uplands (gently sloping plateaus)	Basic igneous rock	Very stony loam	Clay	Stones	35-80 in surface soil	10-20" over hardpan	Slo
						Xerollic Haplargids	Loamy-skeletal, mixed, frigid	Plush	15	Uplands (fault escarpments)	Basic igneous rock	Very stony loam	Very stony loam	Stones, cobbles & gravel	35-80 in profile	40-70" over fractured bedrock	Mod
						Andic Cryoborolls	Fine-loamy, mixed		10	Uplands	Basic igneous rock	Loam to silt loam	Silt loam	None	--	20-36" over bedrock	Mod
						Entic Chromoxererts	Montmorillonitic, frigid		5	Basins	Lake sediments	Silty clay	Silty clay	None	--	60"+	Slo
						Haplorthents	Fine-loamy, mixed, mesic		5	Uplands	Basic igneous rock	Loam	Loam	None	--	36-60" over bedrock	Mod
Very deep to shallow, frigid soils with sandy subsoils on gentle to moderate slopes.	11	4,000-5,000	8-10	90-100	Rangeland Cropland (alfalfa and pasture) - irrigated (pasture) - dryland	Typic Torripsamments	Mixed, frigid	Bonnick	80	Terraces	Basic igneous rock	Loamy sand	Loamy sand	None	--	60"+	Ver
						Xerollic Camborthids	Coarse-loamy, mixed, frigid	Fort Rock	5	Basins	Lake sediments	Loam	Loam	None	--	20-40" over hardpan	Mod
	12	4,000-5,000	8-10	90-100	Rangeland Cropland (irrigated alfalfa and pasture) - limited	Lithic Xerollic Camborthids	Coarse-loamy, mixed, frigid		65	Uplands (ridges & hills)	Igneous rock	Sandy loam	Sandy loam	None	--	8-20" over bedrock	Rap
						Typic Torripsamments	Mixed, frigid	Bonnick	20	Fans	Igneous rock	Loamy sand	Loamy sand	None	--	60"+	Ver

Table 238 - Continued

r- ent ge 5/ of ssn.	Position on Landscape	Parent Material	Texture Surface Soil	Soil Characteristics: Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Soil Qualities and Interpretations: Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass 6/: Dryland	Irrigated	Major Soil Problems	Suitable Land Treatment and Structures
25	Uplands (gently sloping plateaus)	Basic igneous rock	Very stony loam	Clay	Stones	35-80 in top 10"	10-20" over bedrock	Slow	Impervious	Good	Low	VIe VIIe VIIs	--	Shallow over bedrock; stony surface soil	Rangeland management
25	Uplands (gently sloping plateaus)	Basic igneous rock	Very stony loam	Clay	Stones	35-80 in surface soil	10-20" over hardpan	Slow	Impervious in hardpan	Good	Low	VIe VIIe VIIs	--	Stony surface soil; shallow over hardpan; clay subsoil	Rangeland management
15	Uplands (fault escarpments)	Basic igneous rock	Very stony loam	Very stony loam	Stones, cobbles & gravel	35-80 in profile	40-70" over fractured bedrock	Moderate	Slow	Good	Low	VIIs	--	Stony profile	Rangeland management
10	Uplands	Basic igneous rock	Loam to silt loam	Silt loam	None	--	20-36" over bedrock	Moderate	Impervious	Good	Low	VIe	--	Erosion; moderately deep over bedrock	Rangeland management
5	Basins	Lake sediments	Silty clay	Silty clay	None	--	60"+	Slow	Slow	Somewhat poor	High	Vw	--	Wetness; clayey profile; flooding	Rangeland management; drainage; flood protection
5	Uplands	Basic igneous rock	Loam	Loam	None	--	36-60" over bedrock	Moderate	Impervious	Good	Medium and high	IIIe IVe VIe	IIIe	Erosion; droughtiness	Rangeland mgmt; irrigation mgmt;residue mgmt; pastureland management
80	Terraces	Basic igneous rock	Loamy sand	Loamy sand	None	--	60"+	Very rapid	Very rapid	Somewhat excessive	Low	VIe	--	Erosion; sandy profile	Rangeland management
5	Basins	Lake sediments	Loam	Loam	None	--	20-40" over hardpan	Moderate	Impervious in hardpan	Good	Low and medium	IVc	IVc	Moderately deep over hardpan; droughtiness	Rangeland management; irrigation management
65	Uplands (ridges & hills)	Igneous rock	Sandy loam	Sandy loam	None	--	8-20" over bedrock	Rapid	Impervious	Somewhat excessive	Low	VIe	--	Erosion; shallow over bedrock	Rangeland management
20	Fans	Igneous rock	Loamy sand	Loamy sand	None	--	60"+	Very rapid	Very rapid	Somewhat excessive	Low	VIe	--	Erosion; sandy profile	Rangeland management

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Table 238 - Continued

Soil Groups	Soil Association: Map Sym.	Elevation Feet	Precip. Inches	Freeze free Season Days	Major land use	Classification: Great Group or Subgroup	Family	Series[2/]	Percentage[3/] of Assn.	Position on Landscape	Soil Characteristics: Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth
Shallow, rocky miscellaneous land with frigid soils and strong to extremely steep slopes.	13	4,000-5,000	8-10	90-100	Rangeland	--	--	Rockland[5/]	85	Uplands (gently sloping to rolling)	Basic igneous rock	--	--	--	--	0-10" over bedrock
Moderately deep to deep frigid soils with loamy and sandy subsoils on gentle to very steep slopes.	14	4,000-5,500	16-30	60-120	Forest land[4/] Rangeland Cropland (limited)	Argixerolls plus Cryandepts and Haploxerolls	Fine-loamy, loamy-skeletal, mixed, frigid and ashy over fine loamy, frigid	--	100	Uplands (ridgetops and side slopes)	Loess & basic igneous rock	--	--	--	--	20-60" over bedrock
	15	4,500-7,000	16-25	40-90	Forest land[4/] Rangeland	Xeropsamments	Ashy over loamy and cindery, mixed, frigid	--	100	Uplands (faulted & dissected plateaus)	Pumice over loamy material	--	--	--	--	20-70" over buried soils
Shallow to deep, frigid soils with fine loamy and clayey subsoils on moderate to extremely steep slopes.	16	5,000-7,500	16-25	40-90	Forest land[4/] Rangeland	Argixerolls plus Cryandepts and Haploxerolls	Loamy-skeletal and fine, montmorillonitic, frigid	--	100	Uplands (ridge slopes)	Acidic igneous rock	--	--	--	--	10-70"+ over bedrock
	17	5,000-7,000	12-16	40-90	Rangeland	Typic Argixerolls	Fine, montmorillonitic, frigid	Booth	35	Uplands (ridges & hills)	Acidic igneous rock	Very stony loam	Clay	Cobbles 10-35 in & stones top 10"		20-40" over bedrock
						Aridic Lithic Argixerolls	Clayey, montmorillonitic, mesic	Lorella	25	Uplands (ridges & hills)	Acidic igneous rock	Very stony loam	Clay	Cobbles 10-35 in & stones top 10"		10-20" over bedrock
						Pachic Argixerolls	Fine, montmorillonitic, frigid	Mound	25	Uplands (ridges & hills)	Acidic igneous rock	Silt loam	Silty clay loam	None	--	20-40" over bedrock

1/ Based on data summarized during 1966.
2/ Only soil series names that have a status as reserved, tentative, or established are listed.
3/ Differences of total percentage in each soil association from 100 percent are inclusions of other soils and land types.
4/ For the upland forest soils, the above characteristics and qualities have been extended from a limited amount of survey data. Additional data and land use interpretations for forest soils are available in the Forest Land section of Appensix VIII, Land Measures and Watershed Protection. These areas include National Forest and adjacent non-Federal forest lands.
5/ Miscellaneous land types.
6/ Presently irrigated cropland.
SOURCE: National Cooperative Survey

Table 238 - Continued

ition on Landscape	Parent Material	Texture Surface Soil	Texture Subsoil	Coarse Fragments: Kind	Coarse Fragments: Percent	Profile Depth	Permeability Subsoil	Permeability Substream	Drainage Class	Total Available Water-holding Capacity	Range of: Major Capability Subclass: Dryland	Range of: Major Capability Subclass: Irrigated[6]	Major Soil Problems	Suitable Land Treatment and Structures
Uplands (gently sloping to rolling)	Basic igneous rock	--	--	--	--	0-10" over bedrock	--	Impervious	Good	Low	VIIe VIIIs	--	Shallow over bedrock	Limited rangeland mgmt.
Uplands (ridgetops and side slopes)	Loess & basic igneous rock	--	--	--	--	20-60" over bedrock	Moderately slow	--	Good	Medium and low	VIe	--	Erosion with improper land use	Continued forest land mgmt; rangeland mgmt.
Uplands (faulted & dissected plateaus)	Pumice over loamy material	--	--	--	--	20-70" over buried soils	Very rapid	--	Excessive	Medium	VIe	--	Erosion with heavy cover disturbance	Continued forest land mgmt; rangeland mgmt.
Uplands (ridge slopes)	Acidic igneous rock	--	--	--	--	10-70"+ over bedrock	Moderate	--	Good	Medium	VIIe	--	Erosion with improper land use	Continued forest land mgmt; rangeland mgmt.
Uplands (ridges & hills)	Acidic igneous rock	Very stony loam	Clay	Cobbles & stones	10-35 in top 10"	20-40" over bedrock	Slow	Impervious	Moderately good	Low and medium	VIIs	--	Erosion; moderately deep over bedrock	Rangeland management
Uplands (ridges & hills)	Acidic igneous rock	Very stony loam	Clay	Cobbles & stones	10-35 in top 10"	10-20" over bedrock	Slow	Impervious	Good	Low	VIIs	--	Erosion; shallow over bedrock	Rangeland management
Uplands (ridges & hills)	Acidic igneous rock	Silt loam	Silty clay loam	None	--	20-40" over bedrock	Moderately slow	Impervious	Good	Low and medium	VIe	--	Erosion; moderately deep over bedrock	Rangeland management

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Terms listed for total available water-holding capacity are:

Low: Less than 6 inches in profile.
Medium: 6 to 10 inches.
High: More than 10 inches in profile.

The irrigated capability subclasses are an interpretation of limitations and hazards of using only presently irrigated lands. Many areas not presently irrigated may be potentially irrigable but are not included in this classification.

A dash indicates that a column does not apply or there is insufficient data to complete it.

Tables 238 and 239 show characteristics, qualities, interpretations, and extent of soils in Subregion 12. All the land is more than 4,000 feet above sea level, so the soils are relatively cold, the frost-free period is short, and the number of adapted crops is limited. Over 64 percent of the soil is formed in a mixture of residuum-colluvium from basalt rock and loess on lava plains, broken plateaus, and on mountains. Usually the coarse fragments in these soils restrict the use and management. About 14 percent of the soils formed in old lake-laid deposits. These soils are free of coarse fragments and contribute much of the sediment to alluvial deposits that are parent material for the 8 percent of soil on bottomlands. About 3 percent of the soil formed in materials high in quartz and 11 percent was influenced by volcanic ash or pumice.

Table 239 shows the estimated acreage and proportionate extent of the soil association.

Table 239 - Soil Associations Acreage, Subregion 12, 1966

Soil Association			
Map Symbol	Name	Oregon (1,000 acres)	Percent
1	Powder	380.0	3.3
2	Lakeview-Drews	10.0	.1
3	Duripan soils	500.0	4.4
4	Umapine-Stanfield	600.0	5.3
5	Fort Rock-Flagstaff	180.0	1.6
6	Durorthids	35.0	.3
7	Flagstaff	365.0	3.2
8	Frigid soils	320.0	2.8
9	Ozamis	55.0	.5
10	Hart-Plush	7,129.8	62.6
11	Bonnick-Fort Rock	75.0	.6
12	Bonnick	100.0	.9
13	Rockland	70.0	.6
14	Dominantly Argixerolls	575.0	5.0
15	Dominantly Xeropsamments	670.0	5.9
16	Dominantly Argixerolls	230.0	2.0
17	Booth-Lorella	100.0	.9
Total land area		11,394.8	100.0

Source: National Cooperative Soil Survey.

Interpretations and Evaluation

Table 240 relates the land capability classes to the Land Capability Map, figure 3. It must be realized that the Land Capability Map is highly generalized and a specific capability class on table 240 may not be shown. To determine the land capability of any particular area, refer to the soil association symbols listed in the second column of the table and then locate the area of that symbol on the Soil Associations Map, figure 51. Table 240 also shows the acreage and extent of the dominant land capability class for practical segments of the landscape.

Classified on table 241 is the dominant water storage capacity for each soil association in Subregion 12. Each class on the table relates to a similar class on the Water Storage Capacity, figure 4. To locate those areas having contrasting water storage capacity in the upper 5 feet of soil, refer to figure 4, to figure 51 (the subregional Soil Associations Map), and to the following table.

Table 241 - Water Storage Capacity of Soils Generalized to the Soil Associations, Subregion 12, 1966

Classes of Water Storage Capacity 1/	Soil Association Symbols	1,000 Acres	Percent
Class A - Water storage in the soil profile more than 20,000 acre-feet per township.	1-4-9	1,035.0	9.1
Class B - Water storage in the soil profile 10,000 to 20,000 acre-feet per township.	2-8-14	905.0	7.9
Class C - Water storage in the soil profile 5,000 to 10,000 acre-feet per township.	5-7-10-11 15-16-17	8,749.8	76.8
Class D - Water storage in the soil profile less than 5,000 acre-feet per township.	3-6-12-13	705.0	6.2
TOTAL		11,394.8	100.0

1/ Measurement of the Water Storage Capacity is limited to the upper 5 feet of soil or to bedrock.

Source: National Cooperative Soil Survey.

Table 240 - Summary and Distribution of Land Capability Classes, Subregion 12, 1966

	Distribution by Soil Associations 1/			
	Soil Association Map Symbols 2/	1,000 Acres	Percent	Inventoried 1,000 Acres 3/
Class I - Soils in Class I have no limitations or hazards. They are adopted to all uses with a minimum of conservation treatment other than standard conditioning ones. 4/	-	-	-	
Class II - Soils in Class II have few limitations or hazards. Simple conservation practices are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	2	10.0	0.1	94.5
Class III - Soils in Class III have more limitations and hazards than those in Class II. They require more difficult or complex conservation practices when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	1	380.0	3.3	510.0
Class IV - Soils in Class IV have greater limitations and hazards than Class III. Still more difficult or complex measures are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland or wildlife.	5-8	500.0	4.4	545.0
Class V - Soils in Class V have more limitations than Class IV. They are generally unsuited for cultivation, but are well suited for grazing and forestry use. They require good management practices. 4/	9	55.0	0.5	385.0
Class VI - Soils in Class VI have severe limitations or hazards that make them generally unsuited for cultivation. They are suited largely to pasture, range, woodland or wildlife.	3-4-6-7-10 11-12-14-15	10,049.8	88.2	7,495.3
Class VII - Soils in Class VII have very severe limitations and hazards that make them generally unsuited for cultivation. They are suited to grazing, noncommercial, woodland or wildlife.	16-17	330.0	2.9	2,260.0
Class VIII - Soils and land forms in Class VIII have limitations and hazards that prevent their use for cultivated crops, pasture, range or woodland. They may be used for recreation, wildlife or water supply.	13	70.0	0.6	105.0
Total Land		11,394.8	100.0	11,394.8

1/ Class I and 10 percent of other capability classes may be included in areas of Class II. Up to 25 percent of other capability classes may be included in Classes III and IV. Class V and up to 40 percent of other capability classes may be included in Classes VI, VII, and VIII. In areas of rainfall less than 12 inches, large areas of Class VI can be potential Classes I through IV where irrigation water is available.
2/ Refer to the Subregional Soil Association Map, figure 51.
3/ Taken from table 8.
4/ Capability Classes I and V are distributed in small segregated areas over segments of the landscape. Many small areas could not be delineated on the map. This added detail, although still generalized, is commensurate with the subregional level of generalization.

Source: National Cooperative Soil Survey and U.S.D.A. Conservation Needs Inventory adjusted.

The class letter symbol in the first column and the Soil Associations Map numerical symbol listed in the second column may be used to locate those areas having contrasting water storage capacity. Complete utilization of this storage contributes toward a more stable and sustained streamflow.

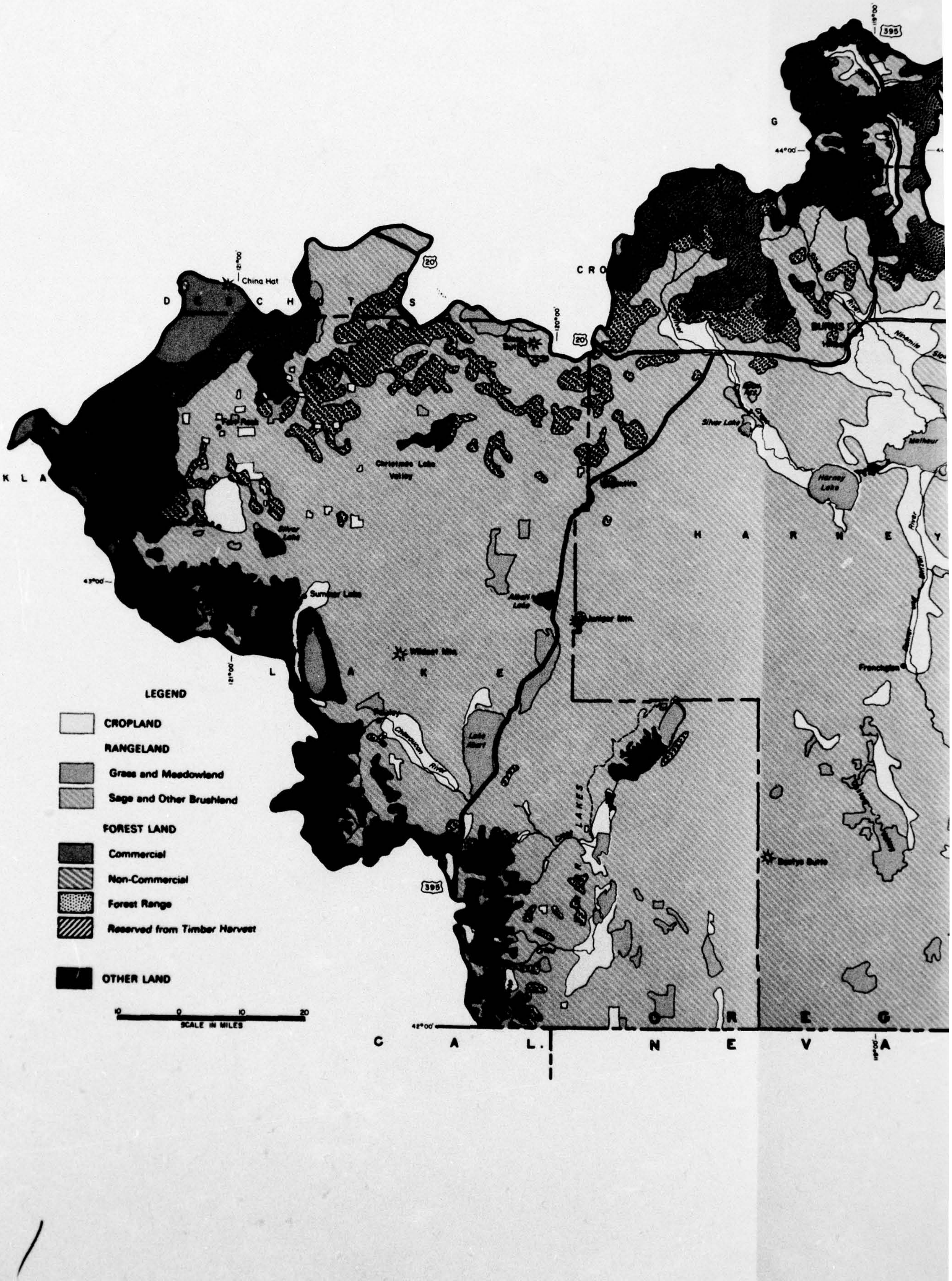
Cover and Land Use

The four major cover and land uses as defined in the glossary and explained in the introduction have been summarized by acreage and ownership on table 242. These broad categories have been determined both on the basis of cover and use. Cropland is more specifically a use category. Forest lands have more than 10 percent forest cover. Rangeland areas have broad range cover characteristics. Other land includes land specifically based on use, such as urban, as well as land based specifically on cover characteristics such as rock and sand dune areas. The four major categories have been generalized for presentation on figure 52. Since this information has been generalized, isolated areas of different cover and uses may occur within the broad patterns.

Table 242 - Cover and Land Use by Ownership, Subregion 12, 1966

Ownership	Cropland	Forest Land	Rangeland	Other Land	Total
		(1,000 acres)			
Department of Agriculture					
Forest Service	-	1,168.5	195.0	.2	1,363.7
Other Agriculture	-	-	14.1	.5	14.6
	-	1,168.5	209.1	.7	1,378.3
Department of the Interior					
Bureau of Land Management	-	343.0	6,073.7	60.0	6,476.7
Bureau of Indian Affairs1/	.3	-	29.9	-	30.2
National Park Service	-	-	-	-	-
Fish & Wildlife Service	23.4	-	280.8	122.6	426.8
Bureau of Reclamation	-	-	-	-	-
Other Interior	-	-	-	-	-
	23.7	343.0	6,384.4	182.6	6,933.7
Department of Defense	-	-	-	-	-
Other Federal	-	-	-	-	-
Federal Subtotal	23.7	1,511.5	6,593.5	183.3	8,312.0
State	-	14.5	274.4	41.1	330.0
County	-	-	-	3.6	3.6
Municipal	-	-	-	.5	.5
Public Total	23.7	1,526.0	6,867.9	228.5	8,646.1
Private Total	341.3	367.0	1,865.2	175.2	2,748.7
Total Land Area	365.0	1,893.0	8,733.1	403.7	11,394.8

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Conservation Needs Inventory and U.S.D.A. Forest Survey adjusted by the Land and Minerals Work Group.



China Hat
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120°00'
119°00'
43°00'
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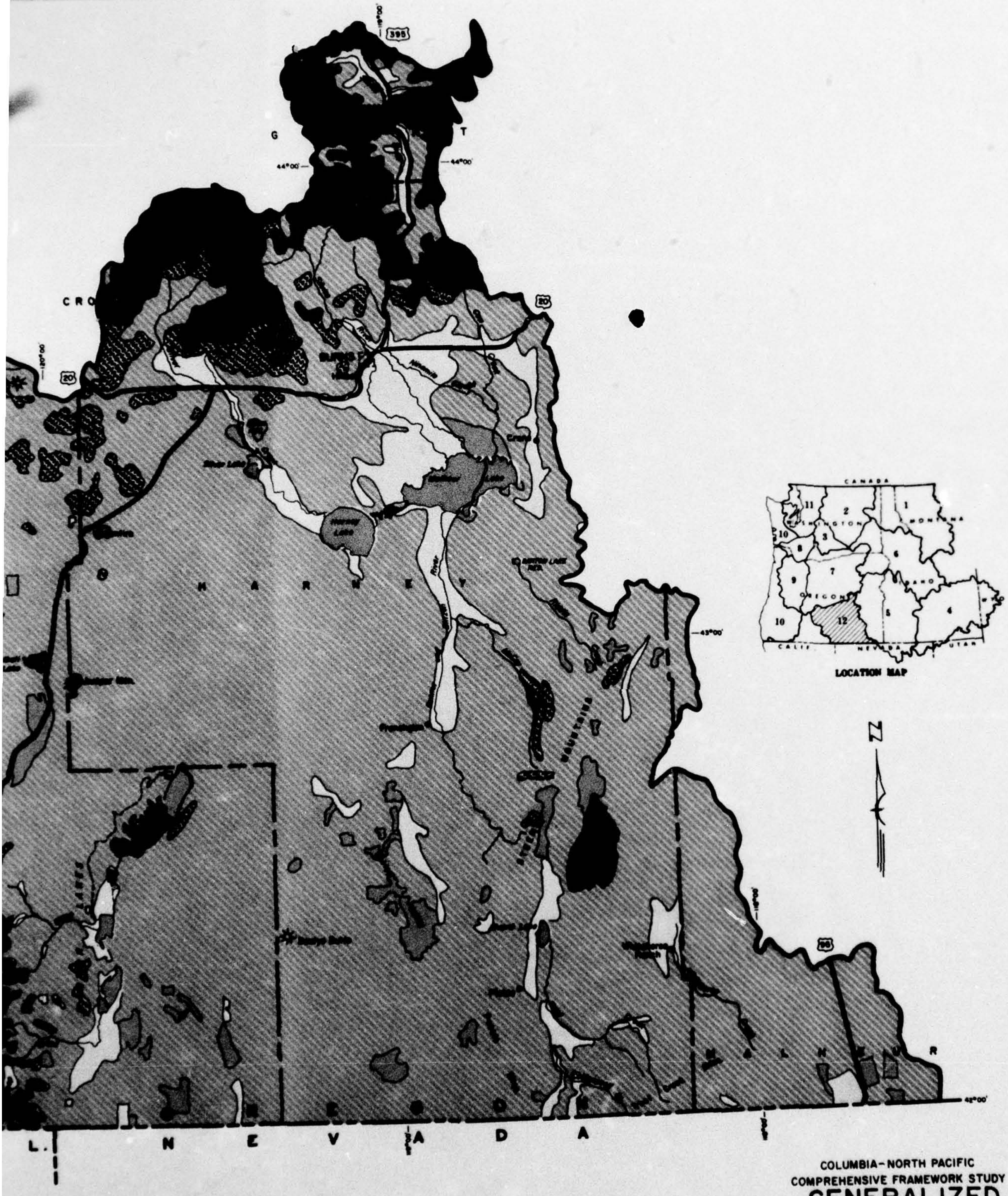
20
395
KLA
Christmas Lake Valley
Silver Lake
Summer Lake
Wildcat Mtn.
Abert Lake
Lake Abert
Chewaucan River
LAKES
Silver Lake
Burns
Harney Lake
Malheur
Frenchglen
H A R N E Y
L A K E
O R E G
C A L.
N E V A
LEGEND
CROPLAND
RANGELAND
Grass and Meadowland
Sage and Other Brushland
FOREST LAND
Commercial
Non-Commercial
Forest Range
Reserved from Timber Harvest
OTHER LAND
10 0 10 20
SCALE IN MILES



COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

GENERALIZED COVER AND LAND USE

OREGON CLOSED BASIN
SUBREGION 12
1966

FIGURE 52

2

Cropland

Cropland in Subregion 12 is generally climatically restricted to growing cereal crops, hay, and pasture either under irrigation or under dryland management. In addition to climatic restrictions, the lack of adequate water supply restricts both the adapted crops and the area that can be used as cropland. Over much of the present cropland area, irrigation is possible only during spring and early summer because of the short water supply. The grain, hay, and pasture crops mainly supplement livestock production as the major agricultural enterprise. Table 243 shows cropland acreage and extent of representative categories of crops.

Table 243 - Cropland Acreage of Representative Categories of Crops, Subregion 12, 1966

Categories of Crops	Oregon (1,000 acres)	Percent
Dryland Cropland1/		
Forage crops	29.9	8.2
Close grown field crops2/	16.7	4.6
Specialty crops3/	1.2	.3
Total dryland crops	47.8	13.1
Irrigated Cropland1/		
Forage crops	300.0	82.2
Close grown field crops2/	17.2	4.7
Total irrigated crops	317.2	86.9
Total cropland	365.0	100.0

1/ Does not include other land that is irrigated (table 28;).
2/ Includes cereal grains.
3/ Includes seed crops.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Forest Land

The forest land covers 1,893,000 acres, or less than 17 percent of the total land area. It is found in a narrow band along the entire western border and in the upper Silvies River Basin in the north. Forests run the short distance from the basin rim to the desert floor where they mix with the sagebrush and desert shrubland below.

About 1.5 million acres, or 81 percent of the forest land is publicly owned. Of this, 77 percent is national forest, 22 percent

Table 244 - Forest Land Acreage by Generalized Type and Ownership, Subregion 12, 1966

Ownership	Commercial Forest Land	Noncommercial Forest Land: Productive Reserved	Noncommercial Forest Land: Unproductive Reserved	Noncommercial Forest Land: Unproductive	Total
			(1,000 acres)		
Forest Service	1,132.5	4.0	-	32.0	1,168.5
Bureau of Land Management	24.0	-	-	319.0	343.0
Bureau of Indian Affairs 1/	-	-	-	-	-
National Park Service	-	-	-	-	-
Fish & Wildlife Service	-	-	-	-	-
Bureau of Reclamation	-	-	-	-	-
Department of Defense	-	-	-	-	-
Other Federal	-	-	-	-	-
Federal Subtotal	1,156.5	4.0	-	351.0	1,511.5
State	1.5	-	-	13.0	14.5
County	-	-	-	-	-
Municipal	-	-	-	-	-
Public Total	1,158.0	4.0	-	364.0	1,526.0
Private Total	251.0	-	-	116.0	367.0
Grand Total	1,409.0	4.0	-	480.0	1,893.0

1/ Private lands held in trust by the Federal Government.
Source: U.S.D.A. Forest Survey, Northwest Experiment Station.

is Public Domain, and 1 percent is owned by the State of Oregon. The balance, 367,000 acres, or 19 percent, is privately owned. Table 244 shows this ownership in more detail.

Timber A little less than 1.5 million acres are classed as commercial forest land, nearly all softwood. The principal species are ponderosa pine and Douglas-fir. Others include the lodgepole pine and true fir-spruce types. The remaining half million acres are noncommercial, mainly the pinon-juniper types found in the desert fringe areas.

Seventy-three percent of the commercial forest area is in the sawtimber class. Seventeen percent is classed as pole timber and 7 percent saplings and seedlings; 3 percent is nonstocked. Except for 4,000 acres in the wilderness category, the entire commercial forest area is available for timber harvest. This area supports over 16 billion board feet of commercial sawtimber, supplying raw material for a forest products industry which furnishes 97 percent of the subregion's manufacturing employment.

Forest Range The forest range occupies a fringe along the west boundary and in the northeastern portion of the subregion. Intermingled are small areas of other types. Included in the forest

range are 1.3 million acres classified as commercial forest land and 0.5 million acres classified as noncommercial forest land. These 1.8 million acres represent 94 percent of the total forest land in the subregion.

About 20 percent of the forest range is in good range condition, 34 percent in fair condition, and 46 percent in poor condition. Carrying capacity of the forest range is estimated at 123,000 AUMs with the private range accounting for 24 percent and the public range 76 percent.

The Federal Government has jurisdiction of 79 percent of the forest range, including 1.1 million acres managed by the Forest Service, and 343,000 acres under Bureau of Land Management control. Private ownership accounts for 367,000 acres or 21 percent of the forest range.

Forage species include bitterbrush, sagebrush, snowberry, ninebark, and oceanspray. Also included are bluebunch wheatgrass, Idaho fescue, pine grass, needlegrass, elk sedge, and a variety of perennial forbs. The forest range receives about 10 to 20 inches of precipitation annually and varies in elevation between 5,000 and 7,000 feet.

Other Uses The forest lands may be more important as watersheds than the producers of the timber supply of the forest industries. Although only 17 percent of the subregion is forested, nearly 43 percent of its runoff develops there.

The forest lands form a significant part of the subregion's recreation resource, furnishing much of the hunting, fishing, and camping environment. The public forest furnished areas and facilities for nearly a quarter million recreation visits in 1965, mostly in the hunting, fishing, and sightseeing categories.

Grazing use by big game species is one of the significant uses of the basin's forest areas. Some 75,000 hunter visits were reported on these forest areas in 1965.

Rangeland

Rangeland in Subregion 12 includes about 8.7 million acres used for grazing by domestic livestock. Rangeland accounts for 77 percent of the subregional land area. This subregion accounts for 15 percent of all rangeland in the region. Table 245 shows the various categories of rangeland by ownership.

Table 245 - Rangeland and Forest Range Acreage by Range Type and Ownership, Subregion 12, 1966

Category	Federal					Non-Federal		
	BLM	FS	BIA	Other	Total	State & County	Private	Total
				(1,000 acres)				
Rangeland								
Grasslands	185.9	32.7	.8	52.2	271.6	8.2	686.5	966.3
Sagebrush	5,838.6	-	29.1	·242.7	6,110.4	260.0	1,085.4	7,455.8
Brushland other than sage	49.2	162.3	-	-	211.5	6.2	93.3	311.0
Total	6,073.7	195.0	29.9	294.9	6,593.5	274.4	1,865.2	8,733.1
Forest Range 1/								
Commercial Forest	24.0	1,032.2	-	-	1,056.2	1.5	251.0	1,308.7
Noncommercial Forest								
Sub-alpine	-	-	-	-	-	-	-	-
Desert Fringe	319.0	32.0	-	-	351.0	13.0	116.0	480.0
Total (noncommercial)	319.0	32.0	-	-	351.0	13.0	116.0	480.0
Total (forest range)	343.0	1,064.2	-	-	1,407.2	14.5	367.0	1,788.7
Grand Total	6,416.7	1,259.2	29.9	294.9	8,000.7	288.9	2,232.2	10,521.8

1/ Forest and woodland grazed or potentially usable for forage production. The forest range acreage is included within the total forest statistics shown on table 244.
Source: U.S.D.A. Conservation Needs Inventory adjusted by the Land and Minerals Work Group.

Rangeland occupies most of the subregion except for a forest fringe on the west boundary between the Klamath and Harney Basins, and forested slopes of the Ochoco Mountains in the northeast part of the area. Intermingled are small areas of hay land principally around Malheur, Harney, Abert, and Summer Lakes and in the Burns vicinity.

About 1.8 million acres or 21 percent of the range is in good condition, 2.2 million acres or 25 percent is in fair condition, and 4.7 million acres or 54 percent is in poor condition. The estimated carrying capacity is 1.1 million AUMs, with private range representing 28 percent and the nonprivate range 72 percent.

Rangeland on soils formed in old lake bed sediments with salts and alkali in the foreground depression. (S.C.S. 000560)

The Federal Government has jurisdiction over 76 percent of the rangeland. Most of this is under the management of the Bureau of Land Management. Another 21 percent of the rangeland is in private ownership, and the remaining 3 percent is state owned.

Grasslands, which include perennial upland grasses and forbs and small areas of meadow land, cover 966,000 acres and account for 11 percent of the range in the subregion. It is estimated that 70 percent is in good condition, 20 percent in fair condition, and 10 percent in poor condition. To a considerable extent, grasslands throughout the subregion are interspersed with areas of sagebrush and other shrubs. Crested wheatgrass is the dominant grass species where the range has been reseeded. Native grass species include squirreltail, Idaho fescue, Sandberg bluegrass, needlegrass and cheatgrass. Tracts of open grassland occur in the forested areas of the subregion. Most grasslands have a gentle slope and soils may be stony. They are located in areas with average annual precipitation of about 7 to 14 inches with isolated higher elevation areas receiving 15 to 18 inches.

Lands which are dominated by sagebrush and similar shrubs cover 7.5 million acres and account for 85 percent of the range. It is estimated that 15 percent is in good condition, 25 percent in fair condition, and 60 percent in poor condition. This range is dominated by big sagebrush, with lesser amounts of low-sage, rabbitbrush, and shadscale. An understory of grasses and forbs occurs throughout the sagebrush area although it varies from area to area. Annual precipitation ranges from about 7 to 10 inches with some higher elevation spots receiving up to 20 inches, most of which occur in winter months.

The "other brush" cover type includes all rangelands where shrubs, other than sagebrush, dominate the aspect. The principal shrub species are bitterbrush and rabbitbrush. This cover type characteristically occupies the foothills and plateau areas. This category includes 311,000 acres or 4 percent of the nonforest range. It occurs primarily along the forest fringe areas and is interspersed with western juniper to the south and east of the forest areas. About 20 percent of this range is in good condition, 41 percent in fair condition, and 39 percent in poor condition.

<u>Other Land</u>

The other land use consists of 403,700 acres or about 3.5 percent of the land area. This includes barren land and rock that make up about 93 percent of the total. About 5 percent of the total is urban, industrial areas, farmsteads, airports, roads, and other miscellaneous use areas. The remaining 2 percent consists of water areas less than 40 acres and streams less than one-eighth mile wide. Table 246 shows the acreage and extent of other land.

Table 246 - Other Land, Subregion 12, 1966

Kinds of Land Use	Oregon (1,000 acres)	Percent
Barren	374.0	92.6
Roads and railroads	12.9	3.2
Small water[1/]	8.7	2.2
Miscellaneous[2/]	8.1	2.0
	403.7	100.0

1/ Water areas less than 40 acres in size and streams less than one-eighth mile in width.

2/ Includes urban and industrial areas, farmsteads, airports, and other areas.

Source: Compiled by the Soil Conservation Service River Basin Staff.

MINERAL RESOURCES

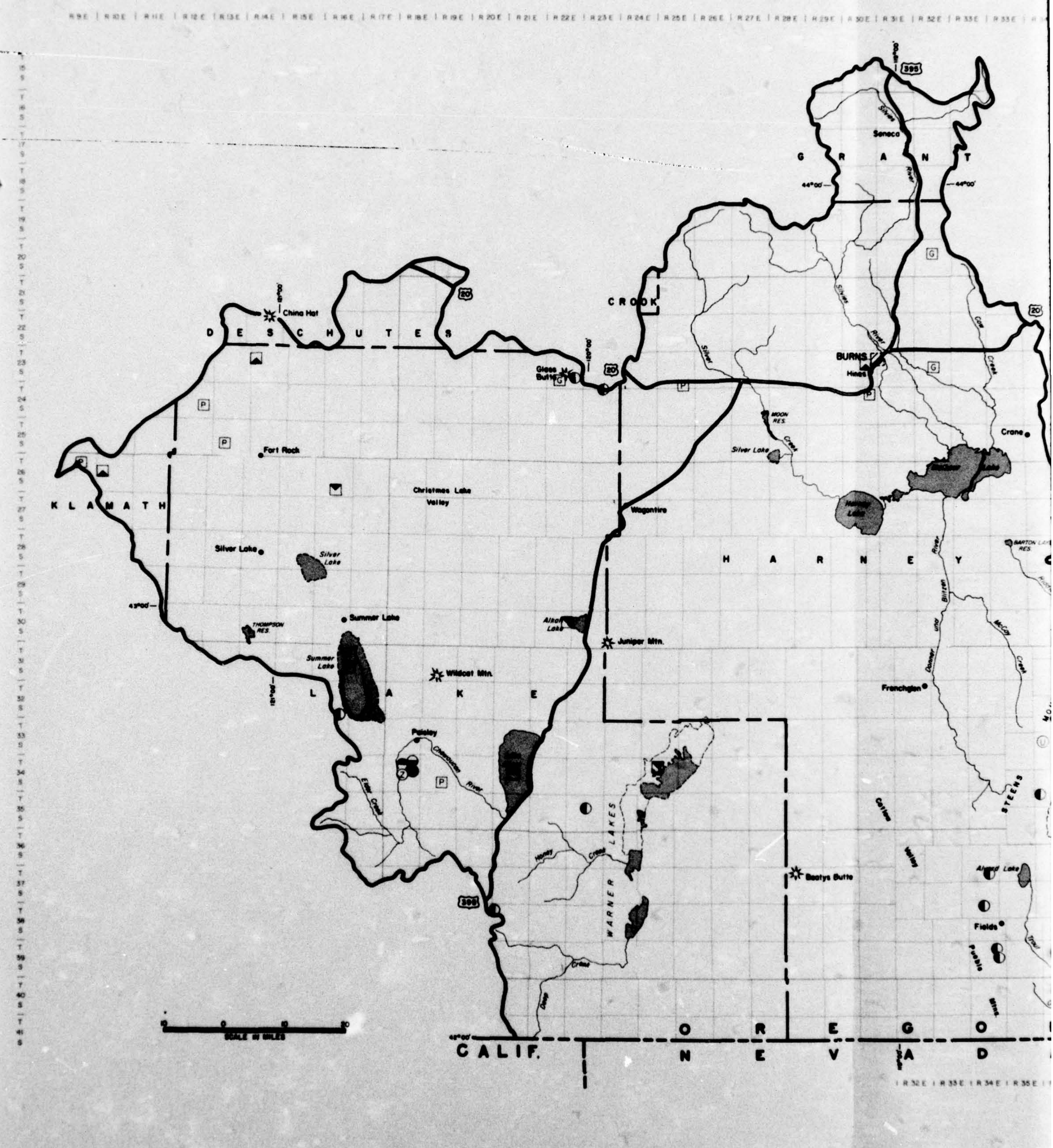
Metals

Gold, silver, lead, and zinc occurrences are known in the Chewaucan River drainage south of Paisley (figure 53). A small production was reported, but there has been no activity in recent years. Scattered occurrences of gold, silver, copper, mercury, and uranium have been reported in the Steens and Pueblo Mountains mostly in the Alvord Lake drainage. Production of several flasks of mercury has been reported from this area.

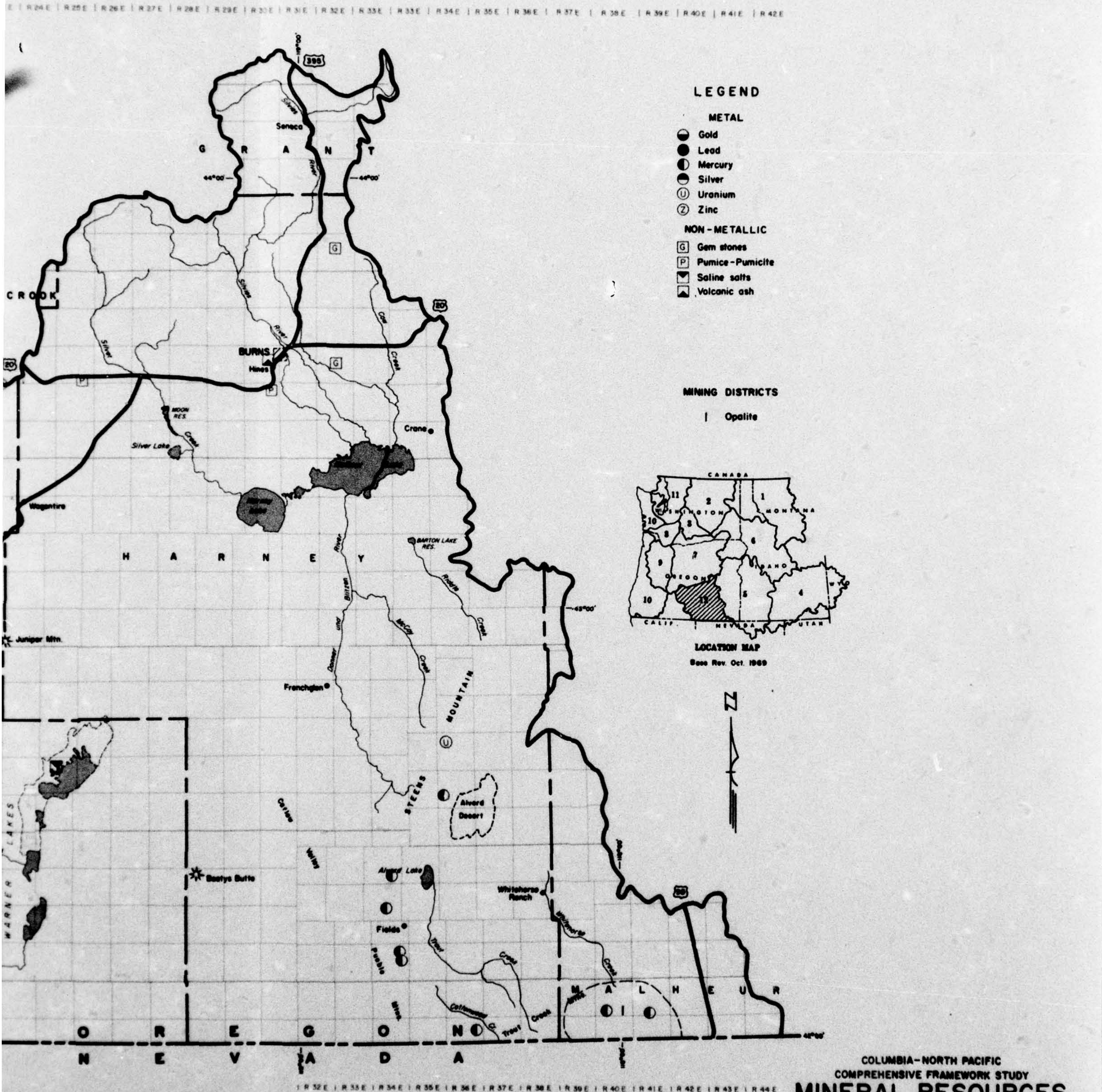
The most important mining district is the Opalite mercury district in the McDermitt Creek drainage, Malheur County, in the southeastern corner of the subregion (table 247). The Opalite and Bretz mines have produced more than 26,000 flasks of mercury; the district ranks second in output in Oregon. The Lakeview District, in the southern part of Lake County, has produced mercury and uranium ore; however, the deposits are in the vicinity of Quartz and Cougar Mountains and are near, but outside the boundary of the subregion.

Table 247 - Mining Districts, Subregion 12

Index No. Fig.	District	County	Drainage	Size of District, Production and Reserves	References
1	Opalite	Malheur	McDermitt Creek	More than 26,000 flasks of mercury have been produced. Future production depends on discovery of ore at deeper horizons.	BuMines Staff, 1965, BuMines Inf. Circ. 8252. Brooks, H.C., 1963, Oreg. Dept. of Geol. and Miner.Ind.Bull.



GRANT
CROOK
DESCHUTES
KLAMATH
LAKE
HARNEY
OREGON
CALIF.
NEVADA
China Hat
Glass Butte
Fort Rock
Christmas Lake Valley
Silver Lake
Silver Lake
Summer Lake
Summer Lake
THOMPSON RES.
Wildcat Mtn.
Paisley
Chewaucan River
Alkali Lake
Juniper Mtn.
Wagontire
WARNER LAKES
Honey Creek
Deep Creek
Beatys Butte
Catlow Valley
Frenchglen
Donner und Blitzen River
McCoy Creek
STEENS
Alvord Lake
Fields
Pueblo Mtns.
BURNS
Hines
Seneca
Silvies River
Silver Creek
MOON RES.
Malheur Lake
Harney Lake
Crane
Cow Creek
BARTON LAKE RES.
395
20
44°00'
43°00'
42°00'
120°00'
SCALE IN MILES



COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

MINERAL RESOURCES AND MINING DISTRICTS

OREGON CLOSED BASIN SUBREGION 12

FIGURE 53

2

Nonmetals

Deposits of construction materials such as basalt, volcanic cinders, and pumice are widespread, and resources are virtually inexhaustible. Several areas contain gem stone materials; "thunder-eggs" are found near Buchanan east of Burns and obsidian (iridescent) occurring at Glass Buttes. Saline deposits are present in many of the pluvial lakes, but little exploration and little or no development have been done.

Present Mineral Industry and Outlook for the Future

Metals

Mercury Mercury is the only metal produced in important amounts. The Bretz mine in the Opalite District has been a substantial producer recently; the production in 1965 (together with the Black Butte mine in Lane County) was about 1,350 flasks. The Bretz mine closed in September 1966, but some exploration by deep drilling has been done seeking extensions of the ore body that can be mined by underground methods. A new mercury treatment plant was under construction at Glass Buttes to process ore from a new open pit mine being developed in 1966. The potential for future mercury production appears to be favorable at a market of $500 or more per flask.

Nonmetals

Construction Materials Crushed stone (basalt), although a low unit priced material, is a valuable mineral commodity. Quarries are located where accessible, and as close as possible to the point of utilization or market. Crushed stone is used for roadstone and aggregate; locally, a few tons of dimension stone are quarried from volcanic tuffs or basalts. Stone ranked second in value of minerals produced in Lake County in 1965.

Sand and gravel, also a low value product, is generally a ubiquitous material and used in large quantities for aggregate in concrete. Sand and gravel was the only mineral produced in Harney County in 1965 and ranked first in order of value of mineral production in Lake County.

Pumice and other pumiceous materials (cinder and scoria) are used for road surfacing, and smaller amounts are used for lightweight aggregate, for cinder blocks, and for pozzolan admixture in concrete.

Deposits of pumiceous materials are very large, and future production will depend on the marketability of the products.

Diatomite Diatomite is produced from deposits in the Silver Lake area, Lake County; a small amount is mined and crushed to pebble size for pet bedding.

Perlite A large perlite deposit occurs about 10 miles south of Paisley. Development and production were started in 1958, and a small output is shipped annually to Supreme Perlite Company in Portland.

Salt The pluvial lakes of central Lake County contain extensive saline deposits. Some production was attempted in the 1950's, but no permanent commercial operation has developed. The deposits represent a potential source of salts for the chemical industry provided costs of treatment and transportation become economic in the future.

Gem Stones Gem materials attract a large group of "rockhounds" and tourists to the subregion annually. This is a recreational industry as no commercial production has been developed. "Thundereggs" are associated with rhyolite flows in eastern Harney County, and "iridescent obsidian" is found in the Glass Buttes area, Lake County.

Mineral Fuels

No coal deposits of economic value have been found. A test hole for oil and gas was drilled in southern Lake County on a favorable structure in 1960, but there was no oil or gas discovery.

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G L O S S A R Y

ACID SOIL - A soil giving an acid reaction (precisely, below pH 7.0; practically, below pH 6.6) throughout most or all of the portion occupied by roots.

ACIDIC ROCK - Composed of over 52 percent silica.

ALKALINE SOIL - For the purpose of this report, a soil management problem involving salts or high pH.

ALLUVIUM - Soil material, such as sand, silt, or clay, that has been deposited by water.

ANIMAL UNIT MONTH - The amount of food or forage required by an animal unit for one month. An animal is one mature cow with calf under 6 months of age or equivalent. Animal unit equivalent varies by agencies for horse, sheep, goats, or wildlife.

AVAILABLE WATER HOLDING CAPACITY - The capacity of a soil to hold water in a form available to plants. Amount of moisture held in soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

BASIC ROCK - Composed of less than 52 percent silica.

BOTTOM LAND - Low land formed by alluvial deposits along a river or stream.

CALCAREOUS SOIL - Soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly to the naked eye when treated with hydrochloric acid. Soil alkaline in reaction, owing to the presence of free calcium carbonate; may be more or less cemented, depending upon concentration and time.

CLAY - As a soil separate, mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

CLAYPAN - A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

COAL - Lignite, subbituminous, bituminous, and anthracite unless specifically designated as one or the other.

COARSE FRAGMENTS - Fragments coarser than very coarse sand. In this report they are defined thus:

Gravelly - 20 to 35 percent by volume of the soil mass is fragments up to 3 inches in diameter.

Very gravelly - 35 to 80 percent by volume of the soil mass is fragments up to 3 inches in diameter.

Cobbly - 20 to 35 percent by volume of the soil mass is fragments from 3 to 10 inches in diameter.

Very cobbly - 35 to 80 percent by volume of the soil mass is fragments from 3 to 10 inches in diameter.

Stony - 20 to 35 percent by volume of the soil mass is fragments more than 10 inches in diameter.

Very stony - 35 to 80 percent by volume of the soil mass is fragments more than 10 inches in diameter.

COLLUVIUM - Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited on slopes.

CROPLAND - Land regularly used for production of crops, except forest land and rangeland.

CROPLAND, IDLE - This includes the land classified as cropland because of prior use but not currently cropped.

CROPLAND, IRRIGATED - Land to which water is usually applied by controlled artificial means.

DRAINAGE CLASS - The relative terms used to describe natural drainage are explained as follows:

Excessive - Excessively drained soils are commonly very porous and rapidly permeable, and have low water-holding capacity.

Somewhat Excessive - Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Good - Well drained soils that are nearly free of mottling and are commonly of intermediate texture.

Moderately Good - Moderately well drained soils that commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the surface layers and upper subsoil, and mottling in the lower subsoils and substrata.

Somewhat Poor - Somewhat poorly drained soils are wet for significant periods, but not all the time. They commonly have a slowly permeable layer in the profile, a high water table, additions through seepage, or a combination of these conditions.

Poor - Poorly drained soils are wet for long periods of time. They are light gray and generally are mottled from the surface downward, although mottling may be absent or nearly so in some soils.

DUFF - A type of organic surface horizon of forested soils consisting of matted peaty organic matter only slightly decomposed.

FARM - A place operated as a unit of 10 or more acres from which the sale of agricultural products totaled $50 or more annually, or a place operated as a unit of less than 10 acres from which the sale of agricultural products totaled $250 or more annually during the previous year.

FEDERAL LANDS - All classes of land owned by the Federal Government, which include both Public Domain land and acquired Federal land.

FEDERAL LANDS, ACQUIRED - Lands acquired by the Federal Government through purchase, condemnation, or gift.

FEDERAL LANDS, WITHDRAWN - Federal lands for which formal withdrawal action has been taken which restricts the disposition of specific public lands and which holds them for specific public purposes; also, public lands which have been dedicated to public purposes.

FORB - Any herbaceous plant which is neither a grass nor a sedge. Ordinarily, forb is used to describe plants which are grazed on western ranges, where a term is needed which will include nonlegumes as well as legumes but distinguishing them from grasses and sedges. In the east, the term forb is not generally used, since any plant on a pasture which is neither a grass nor a legume is considered to be a weed.

FOREST LAND - Land which is at least 10 percent stocked by forest trees of any size and land from which the trees have been

removed to less than 10 percent stocking but which has not been developed for other use.

FOREST LAND, COMMERCIAL - Forest land which is producing, or is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation.

FOREST LAND, NONCOMMERCIAL - Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions, and productive forest land withdrawn from commercial timber use through statute or administrative regulation.

FOREST LAND, NONSTOCKED - Commercial forest land less than 10 percent stocked with growing stock trees.

FOREST LAND, PRODUCTIVE - RESERVED - Public forest land withdrawn from timber utilization through statute, ordinance, or administrative order, but which otherwise qualifies as commercial forest land. Examples include the National Parks and National Forest Primitive and Wilderness areas.

FOREST LAND, UNPRODUCTIVE - Forest land incapable of yielding crops of industrial wood products (usually saw timber) because of adverse site conditions.

FOREST RANGE - Forest land available for the grazing of domestic livestock and wildlife. It may be either commercial or noncommercial forest land.

FRAIL LANDS - Lands characterized by either a thin or unstable topsoil, or in some instances no topsoil whatsoever. Subsoils are normally clays, fine silts, or sands. Frail lands are ordinarily those on which the plant cover is sparse or easily injured, leading to increased runoff or erosion. Many of these areas are geologic parent materials that do not have sufficient soil development to produce a vegetative cover that would stabilize normal geologic erosion. Some of these areas may consist of barren rock or shale deposits.

GULLY EROSION - The widening, deepening, and headcutting of small channels and waterways due to erosion.

HARDPAN - A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

IRRIGATED LAND - Land receiving water by controlled artificial means for agricultural purposes from surface or subsurface sources.

__LACUSTRINE DEPOSITS__ - Stratified materials deposited by lake waters.

__LAND AREA__ - The solid portion of the earth's surface, including bodies of water less than 40 acres and streams of less than one-eighth mile wide.

__LAND CAPABILITY CLASS__ - A group of capability subclasses and units that have the same relative degree of hazards or limitations. The risks of soil damage or limitation in use become progressively greater from Class I to Class VIII.

__LAND CAPABILITY SUBCLASS__ - A group of capability units which have a major conservation problem, either, "e," erosion and runoff; "w," excess water; "s," root zone limitations; or "c," climatic limitations.

__LAND CAPABILITY UNIT__ - A grouping of one or more individual soil mapping units having similar potentials and continuing limitations or hazards. The soils are sufficiently uniform to produce similar crops, require similar conservation treatment, and have comparable productivity.

__LAND RESOURCE__ - An area of land containing or supporting all or some of certain resources in some combination. The resources include soil, water, timber, forage, wildlife, and minerals.

__LAND RESOURCE AREA__ - Broad, geographic area having similar soil, climatic, geologic, vegetative, and topographic features.

__LAND RESOURCE REGION__ - Geographically associated major land resource areas which divide the United States into 20 physiographic regions uniform enough to be significant for national planning.

__LAND TREATMENT MEASURES__ - The application of vegetative measures, tillage practices, and structural installations, individually or in selected combinations, according to land needs and use, to control runoff, prevent erosion, increase fertility, and improve the soil.

__LAND USE__ - Primary occupier of a tract of land grouped into classes with similar characteristics, i.e., cropland, rangeland, forest land, or other.

__LANDSCAPE__ - (As used in soil geography) The sum total of the characteristics that distinguish a certain area on the earth's surface from other areas. These characteristics are the result not only of natural forces, but of human occupancy and use of the land. Included among them are such features as soil types, vegetation, rock formations, hills, valleys, streams, cultivated fields, roads, and buildings.

LOESS - Soil material consisting primarily of uniform silt particles that were transported and deposited by wind.

METALS - Any of various opaque, fusible, ductile, and typically lustrous substances having a chemical element as distinguished from an alloy, which include iron, gold, silver, copper, lead, and zinc.

MICROCLIMATE - Local climatic conditions, brought about by the modification of general climatic conditions by local differences in elevation and exposure.

MINERALS, CONSTRUCTION - Naturally occurring mineral assemblages used primarily in the construction industry.

MINERAL FUELS - Naturally occurring carbonaceous minerals that include petroleum, coal, and natural gas.

MINERAL RESERVES - Discovered ore, coal, petroleum, or natural gas of established extent and grade producible but not yet produced.

MINERAL RESERVES, ECONOMIC - Profitable to mine under the technical and economic conditions existing at time of production.

MINERAL RESERVES, ECONOMICALLY RECOVERABLE - Extractable over a reasonable period of time at a cost which allows for a return on investment, plus a reasonable profit.

MINERAL RESERVES, INDICATED - Tonnage and grade computed from measurements, samples, or production data, and from projection on geological evidence.

MINERAL RESERVES, INFERRED - Quantitative estimates based upon broad knowledge of the geology of the deposit for which there are few samples or actual measurements.

MINERAL RESERVES, MEASURED - Tonnage computed from dimensions revealed in outcrops, trenches, workings, and drill holes with grade derived from detailed sampling.

MINERAL RESOURCE - Known mineral deposit that is regarded as having present or future utility.

MUCK - Fairly well decomposed organic soil material, relatively high in mineral content, dark in color, and accumulated under conditions of somewhat poor drainage.

NATIONAL FOREST LANDS - Federal lands which have been designated by Executive Order or Statute as national forests or purchase

units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones Title III lands.

NEUTRAL SOIL - A soil that is not significantly acid or alkaline; strictly one having a pH of 7.0; practically, one having a pH between 6.6 and 7.3.

NONMETALS - Naturally occurring mineral or assemblage of minerals that lack typical metallic properties such as cement minerals, sand and gravel, stone, lime, clay, phosphate, and potash.

NONSTOCKED AREA - An area of commercial forest land less than 10 percent stocked with growing-stock trees.

ORTSTEIN - Hard, irregularly cemented, dark-yellow to nearly black sandy material formed by soil-forming processes in the lower part of the solum. Similar material not firmly cemented is known as orterde.

OTHER LAND - All land not classified as cropland, rangeland, or forest land is included in this group. Other land includes barren areas, urban areas, and roads, as well as other miscellaneous occupancy.

OUTDOOR RECREATION AREA - A land and/or water area where outdoor recreation is recognized as the dominant or primary resource management purpose.

PEAT - Unconsolidated soil material consisting largely of undecomposed or slightly decomposed organic matter accumulated under conditions of excessive moisture.

PERMEABILITY - The quality of a soil that enables water or air to move through it. The permeability classes are:

Very slow: Less than 0.05 inch per hour.
Slow: 0.05 to 0.20 inch per hour.
Moderately slow: 0.20 to 0.80 inch per hour.
Moderate: 0.80 to 2.50 inches per hour.
Moderately rapid: 2.50 to 5.0 inches per hour.
Rapid: 5.0 to 10.0 inches per hour.
Very rapid: More than 10.0 inches per hour.

PHYSIOGRAPHIC UNITS - Contrasting areas in the landscape that have general similarity in the range of environmental, topographic and physical soil characteristics.

PLANOSOL - A group of soils with cemented or compacted subsoil layers.

PUBLIC DOMAIN LANDS - Original Public Domain lands which have never left Federal ownership; also includes lands in Federal ownership which were obtained by the Federal Government in exchange for public lands, or for timber on public lands.

RANGE CAPACITY (GRAZING CAPACITY) - This is the maximum stocking rate of the range possible without inducing damage to vegetation and related resources or without preventing rehabilitation of previous damage by overgrazing. Capacity is discussed in terms of animal unit months or acres per animal unit month.

RANGE CONDITION CLASS - Range condition estimates are based on a numerical index, rating the forage stand and the site and soil mantle. The numerical ratings have been combined for a comprehensive classification of range condition common to range managing agencies in the following relative terms: Excellent, Good, Fair, Poor, and Bad. In this study the Excellent and Good classifications have been combined as have Poor and Bad categories, and range conditions are discussed in terms of Good, Fair, and Poor.

RANGELAND - Land in grass or other long-term forage growth of native species used primarily for grazing. It may contain shade trees or scattered timber trees with less than 10 percent canopy. It includes grassland, land in perennial forbs, sagebrush land, and brushland other than sage. The term nonforest range is used to differentiate the nonforest range from the forest range when both are being discussed.

RANGELAND, IRRIGATED - Land in grass, or other long-term forage growth, of native species to which water is applied by controlled artificial measures.

RECREATION AREA, DEVELOPED - Land that is developed relatively intensively with any type of recreation facilities, recreation roads, or other visitor improvements. Also included is land adjacent to facilities that receive intensive human use. All or most land in recreation "sites" is considered to fall in this category.

RECREATION AREA, MULTIPLE-USE - Land which is, or can be developed and managed for recreation in combination with other uses.

RECREATION AREA, UNDEVELOPED - Land adjoining a developed recreation area that provides recreation activities such as hunting, hiking, and nature walks. Recreation will be the primary use of such land.

RESIDUAL OR SEDENTARY MATERIAL - Soil material presumably developed from the same kind of rock as that on which it lies.

RILL EROSION - Removal of soil by running water with formation of shallow channels that can be smoothed out completely by normal cultivation.

SALINE SOIL - A soil that contains soluble salts in amounts that impair growth of plants but that does not contain an excess of exchangeable sodium.

SAND - Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

SHEET EROSION - The removal of a fairly uniform layer of soil or materials from the land surface by the action of rainfall and runoff water.

SILT - Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeters) to the lower limit of very fine sand (0.05 millimeters). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

SLICK SPOTS - Small areas in a field that are slick when wet because they contain excess exchangeable sodium, or alkali.

SLOPE - The incline of the land surface, usually expressed in percentage of slope, which equals the number of feet of fall per 100 feet of horizontal distance. In this report, slope is expressed as follows:

0 to 3 percent	Nearly level.
3 to 7 percent	Gently sloping.
7 to 12 percent	Moderately sloping.
12 to 25 percent	Strongly sloping.
25 to 40 percent	Steeply sloping.
40 to 70 percent	Very steeply sloping.
70 to 100 percent and steeper. . .	Extremely steeply sloping.

SOIL - A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting upon parent material, as conditioned by relief over periods of time.

SOIL ASSOCIATION - A group of soils, with or without common characteristics, geographically associated in an individual pattern.

SOIL COMPLEX - A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

SOIL DEPTH - The depth of soil material that plant roots can penetrate readily to obtain water and nutrients. It is the depth to a layer that, in physical or chemical properties, differs from the overlying material to such an extent as to prevent or seriously retard the growth of roots or penetration of water. The depth classes are:

Very deep: More than 60 inches.
Deep: 40 to 60 inches.
Moderately Deep: 20 to 40 inches.
Shallow: 10 to 20 inches.
Very shallow: 0 to 10 inches.

SOIL MAPPING UNIT - A portion of the landscape that has similar characteristics and qualities, and whose limits are fixed by precise definitions.

SOIL MORPHOLOGY - The physical constitution of the soil, including the texture, structure, porosity, consistence, and color of the various soil horizons, their thickness, and their arrangement in the soil profile.

SOIL PROFILE - A vertical section of the soil through all its horizons extending to 60 inches or to a restricting layer.

SOIL RESOURCE GROUP - A grouping of land capability units, or soils that have similar cropping patterns, yield characteristics, responses to fertilizers, management, and land treatment measures.

SOIL SERIES - A group of soils developed from generally similar types of parent material and having genetic horizons that, except for texture of the surface layer, are similar.

SOIL STRUCTURE - The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles.

SOIL TEXTURE - The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are shown as follows.

General Terms		Basic Soil Textural Class Names
Sandy soils -	Coarse-textured soils	Sands Loamy sands
	Moderately coarse-textured soils	Sandy loam Fine sandy loam
Loamy soils -	Medium textured soils	Very fine sandy loam Loam Silt loam Silt
	Moderately fine-textured soils	Clay loam Sandy clay loam Silty clay loam
Clayey soils -	Fine-textured soils	Sandy clay Silty clay Clay

STAND, MEDIUM-STOCKED - A stand that is 40 to 69 percent stocked with present or potential growing-stock trees.

STAND, POLETIMBER - Stand at least 10 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber and poletimber trees, and with poletimber stocking exceeding sawtimber stocking.

STAND, POORLY STOCKED - A stand that is 10 to 39 percent stocked with present or potential growing-stock trees.

STAND, SAPLING, AND SEEDLING - Stand at least 10 percent stocked with growing-stock trees, with more than half of this stocking in saplings and/or seedlings.

STAND, SAWTIMBER - Stand at least 10 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber and poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

STAND, WELL-STOCKED - A stand that is 70 percent or more stocked with present or potential growing-stock trees.

SUBIRRIGATED LAND - Land with a high water table condition, either natural or artificially controlled, that normally supplies a crop irrigation requirement.

SUBSOIL - Roughly, that part of the soil profile below plow depth. Generally 10" to 40" below surface.

SUBSTRATUM - Any layer beneath the soil profile. It applies to the parent material and to layers unlike the parent material that lie below the subsoil.

SURFACE SOIL - The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 10 inches in thickness. The plowed layer.

TALUS - Fragments of rock and soil material collected at the foot of cliffs or steep slopes, chiefly as a result of gravitational forces.

TERRACE (GEOLOGICAL) - An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

TRANSPORTATION, URBAN, AND BUILT-UP AREA (TUB) - Includes cities, villages, other built-up areas of more than 10 acres, industrial sites, railroad yards, cemeteries, airports, gold courses, shooting ranges, institutional and public administrative sites; and the area devoted to roads and railroads.

TYPES - A classification of forest land based upon the predominant species in the present tree cover. Types are determined on the basis of majority of stocking by all live trees of various species, considering both size and spacing.

ULTRA BASIC ROCK - Very rich in calcium and magnesium.

UPLAND (GEOLOGY) - The land consisting of material unworked by water in recent geologic time and generally at a higher elevation than the alluvial plain or stream terrace; land above the lowlands along rivers or between hills.

VOLUME, ALL-TIMER - Net volume in cubic feet of live and salvable dead sawtimber trees and poletimber trees of commercial species, and cull trees of all species from stump to a minimum 4.0-inch top outside bark.

VOLUME, LIVE SAWTIMBER - Net volume in board feet of live sawtimber trees of commercial species. Net volume equals gross volume less deduction for rot, sweep, crook, and other defects that affect use for lumber.

WATER AREA - Water areas of more than 40 acres and water courses more than one-eighth mile wide.

WATERSHED PROTECTION - The treatment of watershed lands in accordance with such predetermined objectives as the control of erosion, streamflow, silting floods, and water, forage, or timber yield.

WILDERNESS AREAS - A collective term used to describe all major areas specially classified and set aside for their primitive and relatively undisturbed esthetic values.

PARTICIPATING STATES AND AGENCIES

STATES

Idaho	Nevada	Utah	Wyoming
Montana	Oregon	Washington	

FEDERAL AGENCIES

Department of Agriculture
  Economic Research Service
  Forest Service
  Soil Conservation Service
Department of the Army
  Corps of Engineers
Department of Commerce
  Economic Development Administration
  Weather Bureau
Dept. of Health, Education, & Welfare
  Public Health Service
Dept. of Housing & Urban Development
Dept. of Transportation

Department of the Interior
  Bonneville Power Administration
  Bureau of Indian Affairs
  Bureau of Land Management
  Bureau of Mines
  Bureau of Outdoor Recreation
  Bureau of Reclamation
  Fed. Water Pollution Control Adm.
  Fish and Wildlife Service
  Geological Survey
  National Park Labor
Department of Labor

Federal Power Commission

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